BP 8: Posters - Bioimaging and Spectroscopy

Time: Monday 17:30–19:30 Location: P3

BP 8.1 Mon 17:30 P3

Adjustment of pulsed laser radiation for stroboscopic experiments — •Benedikt Kamp[1], Tobias Löffler[1], Julia Kristin[2], and Mathias Getzlaff[1] — [1]Institute of Applied Physics, Heinrich-Heine-Universität Düsseldorf — [2]Hals-Nasen-Ohrenklinik, Universitätsklinikum Düsseldorf

This contribution aims to adjust the pulsed laser radiation of a fluorescence microscope depending on an electrical voltage. Through this a stroboscopic effect can be achieved and the periodic movement of an observed probe can be researched in even more detail. The described microscope already has an integrated array of shutters, which are operated by TTL-signals. First the incoming alternating voltage is regulated in amplitude and filtered. The resulting sinewave is converted into a rectangular voltage of 5V by a comparator, so that it can be used as TTL-signal. This signal runs through monostable multivibrators, in which the time ratio of the logic "high" and "low" can be changed with external potentiometers without changing the frequency. It results in a device that can change the time length and phase of the "high", in order to be able to control the shutters accordingly. Furthermore the device possesses overvoltage protection, so that the microscope cannot suffer damage. In future, for even better usage of the stroboscopic effect, a counter can be implemented for limiting the frequency the shutters have to work at.

BP 8.2 Mon 17:30 P3

Luminescence characterisation of fluorescent Nanodiamond — •Frederike Erb[1], Boris Naydenov[2], Ulla Nolte[1], Fedor Jelezko[2], and Kay-E. Gottschalk[1] — [1]Institute of Experimental Physics, Ulm University, Germany — [2]Intstiute of Quantum Optics, Ulm University, Germany

Fluorescent nanodiamonds (FNDs) offer various new imaging and metrology approaches, especially in the life sciences. Nanodiamonds containing nitrogen-vacancy centers as fluorophores emit light in the near-infrared window of bioimaging [1]. Their luminescence properties depend on the environment and thus FNDs can not only be used for bioimaging but also find an application as part of various biosensors. In contrast to dye molecules, FNDs neither blink nor bleach. Moreover, as they are biocompatible, non cytotoxic and do not affect proliferation, they can be used for longtime experiments in live cells [1].

We present luminescence properties of FND and their performance as markers in cells.

References:

[1] Hsiao, Wesley Wei-Wen; Hui, Yuen Yung; Tsai, Pei-Chang; Chang, Huan-Cheng (2016): Fluorescent Nanodiamond: A Versatile Tool for Long-Term Cell Tracking, Super-Resolution Imaging, and Nanoscale Temperature Sensing. In: Accounts of chemical research 49 (3), p. 400-407.

BP 8.3 Mon 17:30 P3

Staining of squamous cell carcinoma cells and dysplastic oral keratinocytes — •Jan Lietz[1], Maja Strugacevac[1], Ayse Almaci[1], Julia Kristin[2], Marcel Glaas[2], Jörg Schipper[2], and Mathias Getzlaff[1] — [1]Institute of Applied Physics, Heinrich-Heine-Universität Düsseldorf — [2]Hals-Nasen-Ohrenklinik, Universitätsklinikum Düsseldorf

The goal of this research is to investigate the differences between oral carcinoma cells (UD-SCC-1) and dysplastic oral keratinocytes (DOK). In order to obtain more information about cell properties confocal laser scanning microscopy is used.

The cell membrane as well as the cytoskeleton, mitochondria and nucleus of both, squamous cell carcinoma cells and oral keratinocytes, were stained with CellMask green, SiR-tubulin and SiR-actin, MitoTracker orange and Hoechst 33342, respectively.

This contribution focuses on combining two, three and four different fluorescent dyes and optimizing the staining process accordingly. In addition, we acquired z-stacks and present reconstructed 3D images for each of the two cell lines.

BP 8.4 Mon 17:30 P3

An integrated platform for rapid semi-confocal imaging and spatially resolved fluctuation microscopy — •Adal Sabri, Andreas Veres, and Matthias Weiss — Experimental Physics 1, University of Bayreuth

Fluorescence imaging is a key method to study the dynamics of biological specimen. Due to the common trade-off between spatial and temporal resolution, rapid high-quality data acquisition often comes at the cost of complex and technically challenging methods.

We report on a technique that increases the temporal resolution of image acquisition by more than an order of magnitude as compared to standard confocal microscopy approaches. Large areas (up to 450μm edge length) can be imaged rapidly with a resolution close to the diffraction limit. To this end, multiple cylindrical lenses shape a thin light sheet so that effectively only a line within a thin specimen (oriented perpendicular to the optical axis) is illuminated. This line of illumination is scanned in one spatial direction with a Galvo mirror. A slit aperture in the detection path yields an axial discrimination, thus creating a semi-confocal setup.

Swift switching to a second excitation/detection path allows for alternating between advanced rapid image acquisition and two-point fluctuation spectroscopy on smaller scales. The setup allows one to correlate fluorescence fluctuations at two selectable, spatially separated foci over time to determine local transport coefficients, hence supports the combination of a rapid imaging and the analysis of dynamic intracellular events on a subcellular scale.

BP 8.5 Mon 17:30 P3

Photothermal detection of single gold nanoparticles in living fibroblasts — •Alice Abend, Romy Schachoff, and Frank Cichos — Universität Leipzig

Live cell bioimaging allows for the observation of cellular processes and their dynamics and provides insight into functions of cells such as metabolism, replication and movement. Modern nanotechnology enables manufacturing of nanometer sized objects with tailored optical properties and specific functionalization which turns them into ideal optical probes for several imaging techniques. We deliver gold nanoparticles (AuNPs) to the cells (NIH/3T3) as they are photostable and allow for long term imaging and seem to be less toxic to living organisms in comparison to semiconductor quantum dots. Our imaging method, photothermal optical microscopy, provides sensitive detection of AuNPs and is therefore suitable to prove the presence of AuNPs in the fibroblasts' interior. As photothermal microscopy is based on heating of the contrast agent, AuNPs can double as heat sources for inducing local intracellular temperature fields which could be useful to manipulate cellular functions such as protein synthesis, metabolism processes and cell motility.

BP 8.6 Mon 17:30 P3

Quantitative Phase Microscopy with a Single Shot Measurement Technique — •Tobias Neckernuss[1], Jonas Pfeil[1], Christoph Koch[2], and Othmar Marti[1] — [1]Institute of Experimental Physics, Ulm University — [2]Department of Physics, Humboldt University of Berlin

In cellular biophysics, there are numerous interesting questions concerning the height of cells under different conditions. However, using classical microscopy techniques recovering the height of an object is related to determine the phase change of the light and is a tough task. Most of the common phase retrieval methods require a stack of images and hence are limited to nonmoving cells since it takes several seconds to capture all images. A second possibility is interferometry where the most critical point is the mechanical stability of the setup so that it is often not applicable in normal laboratories. We introduce an inline holography setup where we use the transport of intensity equation (TIE) to recover the optical path length of the sample from two differently focused pictures. The pictures are taken simultaneously which means that camera speed is the only limitation and therefore changes up to 100Hz can be resolved. Several refinements had to be applied to the reconstruction algorithm in order to get it working since it was originally designed for electron microscopy using more than two pictures. We use a partially coherent LED lamp to avoid common artifacts emerging from laser illumination. Data of polystyrene beads on surfaces as well as of adherent cells in medium is shown. We will compare the reconstructed height with the real ones measured by AFM.

BP 8.7 Mon 17:30 P3

Fluorescent Gold Nanoparticles on/in Cells Visualized by Fluorescence-Lifetime Imaging Microscopy — •Marina Mutas, Tim Hadler, Christian Strelow, Tobias Kipp, and Alf Mews — Institut für Physikalische Chemie, Universität Hamburg

Fluorescence-Lifetime Imaging Microscopy (FLIM) is a powerful method to discriminate emitters with different fluorescence lifetimes. Gold nanoclusters with mercaptoundecanoic acid as stabilizing ligand (MUA-AuNCs) show a fluorescence emission that peaks at a wavelength around 525 nm with decay times longer than 100 ns. The autofluorescence of biological cells is in the same wavelength region but the fluorescence decay time, which is about 3 ns, is much shorter. We are able to specifically biofunctionalize these MUA-AuNCs with an aptamer which binds to a receptor expressed on the cells' membrane. To get an image of the whole cell we use cross-sectional FLIM scans in axial direction at different heights through the cell. With this technique we are able to visualize specifically bound aptamer-MUA-AuNCs on the cells' membrane using three FLIM methods and reflection images.

BP 8.8 Mon 17:30 P3

Robust control of spins in nanodiamonds in complex environments — •Philipp Konzelmann[1], Torsten Rendler[1], Andrea Zappe[1], Sebastian Zaiser[1], Matthias Widmann[1], Sang Yun Lee[2], Philipp Neumann[1], Jörg Wrachtrup[1], and Florian Dolde[3] — [1]3rd Institute of Physics, IQST and SCOPE, Stuttgart — [2]Korea Institute of Science and Technology — [3]DNT Inc.

Nanodiamonds (ND) had been shown to be of excellent biocompatibility and additionally can host color centers. One of the most prominent representatives is the so-called nitrogen vacancy center (NV) that features, due to its unique spin system, the intrinsic capacity to sense for example magnetic or electric fields, pressure and temperature [1]. Furthermore, intense progress in functionalization of ND surface in past years promises a manifold of different applications in life science [2]. However, keeping control of the NV spin sublevel, especially in complex environments, remains challenging. If a ND changes for example its orientation, variations in excitation strength and shifts of the NV spin transitions are expectable. To overcome this obstacle several techniques had been developed exhibiting a certain robustness against such fluctuations [3,4,5]. To this end, we utilize optimum control theory in combination with so-called cooperative pulse schemes [5]. In our work, we present a systematical study exploring the efficiency of such pulses for NVs in NDs. [1] R. Schirhagl et al., ARPC 65: 83-105 (2014) [2] D.G. Lim et al., Int. J. Pharm. 514: 41-51 (2016) [3] M. Garwood et al., JMR. 153: 155-177 (2001) [4] A. M. Souza et al., PRL 106: 240501 (2011) [5] M. Braun et al.., NJP 16 (2014)

BP 8.9 Mon 17:30 P3

Improving tissue transparency by combinatorial expression of crystallins — •Samet Kocabey, Heike Petzold, Kaushikaram Subramanian, and Moritz Kreysing — MPI-CBG, Dresden, Germany

The optical access to biological tissues has long been a goal for scientists to get physiological information. Most tissues show poor optical quality due to the light scattering emerging from heterogeneous refractive index distribution. There are few exceptions including the eye-lens where the cells in the light path leading to the retina have evolved to be transparent that allows minimal light scattering before sensed by retina.

The lens fiber cells are largely comprised of crystallin proteins assembled into a highly ordered macro-structure essential for tuning the refractive index and thus lens transparency. The crystallin proteins have chaperone-like activity and mutations in crystallins cause protein aggregation that leads to cataract formation. However, the precise mechanism by which crystallin proteins maintain the lens transparency is poorly understood. In this study, we aim to find the genetic determinants of lens tissue transparency and ultimately enhance the optical properties of other tissues by combinatorial expression of crystallins and crystallin-related proteins in cells from different tissues.

BP 8.10 Mon 17:30 P3

Beyond the beaten track: Pushing the limits of fluorescence microscopy — •Hannah S. Heil[1], Benjamin Schreiber[1], Si-Yun Liu[1], Martin Kamp[2], Markus Sauer[3], and Katrin G. Heinze[1] — [1]Rudolf Virchow Center, Research Center for Experimental Biomedicine, University of Würzburg — [2]Technische Physik, University of Würzburg, Am Hubland, 97074 Würzburg, Germany — [3]Department of Biotechnology and Biophysics, Biozentrum, University of Würzburg

Combining optical with plasmonic approaches opens exciting perspectives for fluorescence microscopy: So called surface plasmons in specially designed nanostructures can generate extremely high photon densities in a nanoscopic volume that is much lower than the Abbe criteria usually allows. The interaction of fluorophores with plasmonic surfaces enables amplified fluorescence, increased photostability and distance dependent dynamical and spectral emission shifts. All of these effects are very welcome in pushing the two fundamental limits of fluorescence microscopy: contrast and resolution, particularly in the axial dimension. The strength of the approach is that - except for special cover glasses - no special microscope setup is required. Here we show that biocompatible plasmonic nanostructures fabricated on microscopy slides can improve the resolution of the super-resolution technique dSTORM by boosting the signal and thus the localization precision by a factor of two. Finally we give an outlook on how the plasmonic effects could allow 3D reconstructions of molecular distributions and interactions in live cells with nanometer precision.

BP 8.11 Mon 17:30 P3

GPU-based 3D statistical multi-resolution estimators for image reconstruction — •Stephan Kramer[1], Johannes Hagemann[2], and Simon Stein[3] — [1]Fraunhofer ITWM, Kaiserslautern — [2]Institut für Röntgenphysik, Universität Göttingen — [3]III. Institut für Physik, Universität Göttingen

We extend our previous work [1] on statistical multiresolution estimators (SMRE) to 3D. SMREs are a recent development for the deconvolution of noisy images. Their main feature is the replacement of unphysical regularization parameters by only one which represents the probability that the reconstructed image fulfills the hypothesis test for being the correct one. Their convergence does not degrade with increasing noise. In each iteration step of an SMRE the reconstructed noise is tested whether it obeys a pre-defined distribution on all subsets of the input image. Since the number of possible subsets of an image grow exponentially with its size SMREs are computationally expensive. Reasonable runtimes can only be achieved by a careful parallelization [1] and a proper choice of the image subsets on which the statistical tests are performed. Our implementation is based on our SciPAL library [2] and CUDA. As sample application we discuss preprocessing the time series needed in super-resolution optical fluctuation imaging (SOFI) methods for 3D stacks of images from fluorescence microscopy.

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[2] Kramer, S.C. and Hagemann, J., 2015. ACM TOPC, 1(2), p.15.

BP 8.12 Mon 17:30 P3

Network properties and dynamics of the endoplasmic reticulum — •Lorenz Stadler, Konstantin Speckner, and Matthias Weiss — University of Bayreuth, Bayreuth

The endoplasmic reticulum (ER) is an essential cellular organelle that assumes the shape of an extended network of interconnected membrane tubules and sheets. Being responsible for crucial cellular functions, e.g. protein folding and lipid synthesis, malfunctions of the ER are linked to severe diseases. To gain insights into the dynamic ER morphogenesis, we have used fluorescence imaging with high spatiotemporal resolution. ER images taken in cells at different states were skeletonized in a custom-made procedure, hence reducing the organelle's shape to planar graphs composed of edges and nodes. These graphs were analyzed via a set of network measures to quantify topological and geometrical features. Moreover, the motion of network nodes as well as the motion of membrane domains on the ER were analyzed in the presence and absence of cytoskeletal elements. These data highlight the role of active fluctuations for the ER's dynamic morphogenesis in the crowded interior of living cells.

BP 8.13 Mon 17:30 P3

Direct characterization of the evanescent field in objective-type total internal reflection microscopy — •Christian Niederauer, Philipp Blumhardt, Jonas Mücksch, Michael Heymann, Armin Lambacher, and Petra Schwille — Max Planck Institute of Biochemistry, Am Klopferspitz 18, 82152 Martinsried, Germany

Total internal reflection fluorescence microscopy (TIRFM) is a powerful tool to study the interaction of molecules in close proximity to a surface. Usually, the axial TIRFM excitation profile is assumed to be a single-exponential with a characteristic penetration depth.
Exploiting the full potential of TIRFM data requires a precise knowledge of the excitation profile. In a first approximation, the depth of

the evanescent field can be estimated from geometrical considerations. However, significant deviations from the assumed theoretical single-exponential profile have been observed in objective-type TIRFM [1]. Available methods to characterize the precise shape of the axial excitation profile require special instrumentation [2,3], sophisticated sample preparation [3] or are not applicable at typical refractive indices [1]. Here, we present our work on a new approach to quantify the axial TIRFM excitation profile. Our goal is to fabricate a robust and user-friendly micropatterned slide for in situ calibration.

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[2] Sarkar, A., et al., PNAS **101**, 12882–12886 (2004).
[3] Gell, C., et al., J. of Microscopy **234**, 38–46 (2009).

BP 8.14 Mon 17:30 P3

PDMS micro-moulds as test samples for Scanning Ion Conductance Microscopy — Annelie Marx[1], •Regina Lange[1], Henrike Rebl[2], Barbara Nebe[2], Ingo Barke[1], and Sylvia Speller[1] — [1]University of Rostock, Institute of Physics, 18059 Rostock — [2]University Medical Center Rostock, Dept. of Cell Biology, 18057 Rostock

Scanning Ion Conductance Microscopy (SICM) is a less known scanning probe method that uses a nanopipette with an opening diameter below 100 nm as probe. The topography of a soft non-conducting material placed in a (conducting) liquid is measured on the nanoscale, avoiding direct forces between the sample and the probe. Hence, SICM represents a good choice for in vitro high resolution imaging of living cells in physiologic medium. Therefore, among others, the influence of the substrate structure and of potential, or of light on the cell behaviour can be studied in real time.

For testing the SICM method and for making available prospective substrates for cell adhesion experiments we prepare PDMS (polydimethylsiloxane) micro-moulds of various samples. For instance moulds of dry etched glass structures exhibiting equidistant grids and pillars of different aspect ratios with vertical side walls are produced. To compare the replica with their original both were studied by AFM. A decent reproduction quality was obtained with 2 micrometer deep grooves and unity aspect ratio.

BP 8.15 Mon 17:30 P3

Investigating the temperature dependence of lipid mobility in free-standing membranes using circular scanning fluorescence correlation spectroscopy — •Araceli Sebastián, Jonas Mücksch, Philipp Blumhardt, Laura Kacenauskaite, Christian Niederauer, Eugene P. Petrov, and Petra Schwille — Max Planck Institute of Biochemistry, Am Klopferspitz 18, 82152 Martinsried, Germany

Circular scanning Fluorescence Correlation Spectroscopy (csFCS) is a calibration-free alternative to conventional static point FCS [1,2]. Not only does csFCS allow for the direct determination of the diffusion coefficient, but, in case of quasi-planar membranes, also avoids potential errors originating from imprecise axial positioning. Previously, csFCS has been used to measure diffusion in giant unilamellar vesicles (GUVs), serving as a model of free-standing lipid membranes [3]. Despite the immanent importance of model membranes, their temperature-dependent lipid mobility has been subject to only few studies. Here, we report on our progress of employing csFCS to systematically characterize the diffusion in GUVs over a wide range of temperatures.

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BP 8.16 Mon 17:30 P3

Super-Resolution by Structured-Illumination-Axial-Tomography (SIAT) — •Florian Schock[1,2,3], Verena Richter[4], Thomas Bruns[4], Udo Birk[1,3], Rainer Heintzmann[5,6], Herbert Schneckenburger[4], and Christoph Cremer[1,2,3] — [1]Institute of Molecular Biology, University of Mainz — [2]Institute of Pharmacy and Molecular Biotechnology, University of Heidelberg — [3]Kirchhoff Institute for Physics, University of Heidelberg — [4]Aalen University of Applied Sciences, Institute of Applied Research, Aalen, Germany — [5]Institute for Physical Chemistry and Abbe Center of Photonics, University of Jena — [6]Leibniz Institute of Photonic Technology, Jena, Germany

Since the first developments of super-resolution-microscopy (SRM), methods allowing to circumvent ("break") the Abbe limit of optical resolution, a variety of different complementary SRM techniques were discovered. Due to differences in the mode of operation, a further optimization of super-resolution imaging can be achieved by appropriate combinatorial strategies. One of these is the combination of Structured-Illumination-Microscopy(SIM) and Micro-Axial-Tomography (AT). Both of them operate in the visible range spectra and are usable for live-cell imaging. While SIM allows for a resolution-improvement of a factor 2 in all spatial directions (3D), together with appropriate image processing, SIM-AT makes it possible to achieve a homogeneous effective resolution down to 100nm in all directions.

BP 8.17 Mon 17:30 P3

Coherent imaging of biological systems with ultrabright electron pulses — •Robert Bücker[1], Philipp Pelz[1], Gopal Singh[1], Chiwon Lee[1], Nariman Khazai[2], Pascal Hogan[1,2], Sercan Keskin[1], Sana Azim[1], Albert Casandruc[1], Eike Schulz[1], Günther Kassier[1], and R. J. Dwayne Miller[1,2] — [1]Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — [2]Departments of Chemistry and Physics, University of Toronto, Toronto, Canada

High-brightness electron pulses as an ideal probe for structural dynamics are employed in a variety of experimental schemes spanning orders of magnitude in their accessible spatial and temporal scales, from mapping atomic motions driving phase transitions to real-space movies on the nano scale. Further extending this scope - in particular into the realm of complex and fragile biomolecules - will require improvement of electron sources in terms of current and coherence, as well as exploration of imaging techniques that maximize the information gathered from each scattered particle, hence minimizing beam-induced damage.

In this contribution, we present concepts of and first results from experimental setups designed for coherent imaging and protein crystallography using electron pulses in the nanoseconds to milliseconds regime. These comprise different electron energies, imaging modalities, and electron source technologies. Also methods for interferometric beam characterization, and theory developments for optimal reconstruction of the sample from diffracted intensities will be shown.

BP 8.18 Mon 17:30 P3

A theoretical framework for spatiotemporal chemical imaging with nanosensors — •Daniel Meyer, Annika Hagemann, and Sebastian Kruss — Institute of Physical Chemistry, Göttingen University, Germany

Fluorescent nanosensors provide many beneficial properties and are often used to gain precise single-molecule data from biological system. The collective imaging of many sensors can, moreover, supply spatial and temporal information about the local concentration of a given analyte and thus is able to identify fast changing processes on a nanoscale. This idea of chemical imaging with nanosensors becomes attractive when studying chemical signaling between cells. We developed a theoretical framework to simulate the fluorescence image of arrays of nanosensors in response to a spatiotemporal concentration profile. We especially focus on the role of sensor kinetics as it determines how fast sensors can report about concentration changes. For that purpose, the (fluorescence) response of each single nanosensor is modeled with a Monte-Carlo simulation that describes the binding/debinding of the analyte and the respective fluorescence change. Multiple nanosensors are arranged on a surface and exposed to a concentration pattern c(x,y,t) of an analyte. We account for the Abbe-limit and the acquisition speed and resolution of the optical setup and determine the resulting sensor array response images I(x,y,t). Consequently we introduce terms for the spatial and temporal resolution and simulate phase diagrams that allow us to predict the best binding properties of our nanosensors for fast release events such as neurotransmitter releases.

BP 8.19 Mon 17:30 P3

Wavefront-shaping for flow-field measurements — •Bob Fregin[1], Nektarios Koukourakis[2], Jörg König[3], Jürgen Czarske[2], and Oliver Otto[1] — [1]Universität Greifswald, Greifswald, Germany — [2]Technische Universität Dresden, Dresden, Germany — [3]IFW Dresden, Dresden, Germany

Flow-field measurements within (non)-stationary fluid systems are important for several applications in process engineering and biomedi-

cal sciences. However, there are environments like biological tissues where experimental assays are impeded by aberrations or scattering. The latter could lead to a strong increase in measurement uncertainty. Supported by the technological progress of spatial light modulators (SLM) and wave front sensing techniques, sensor-based adaptive optics enables to overcome these limitations, as it allows for flexible and dynamic control of light-fields.

In this contribution we analyze the usage of time-reversal and wave front shaping techniques for both turbidity suppression and aberration correction. The effect of scattering or fluctuating media, e.g. inside a microcapillary, on the measurement accuracy of image-correlation based flow-field measurements is investigated and results of first measurements and simulations are presented and limitations are discussed. We show that time-reversal, digital holography and wavefront shaping techniques have the potential to strongly improve the quality of disturbed flow-field measurements with application inside Biology and Biochemistry.

BP 8.20 Mon 17:30 P3

X-Band Electron Paramagnetic Resonance (EPR) Measurements of Absorbed Dose by Gamma Irradiated Fossil Tooth Enamel — •Ozgul Karatas[1,2], Refik Kayali[1], and Vladislav Kataev[2] — [1]Omer Halisdemir University, Faculty of Science and Letter, Physics Department, Nigde, Turkey — [2]Leibniz Institute for Solid State and Materials Research IFW, Institute for Solid State Research, Dresden, Germany

The measurement of the concentration of stable free radicals in the calcified tissues, such as tooth, due to the radiation is directly related to absorbed dose and it has been used for dose assessment in retrospective dosimetry and dating studies. When tooth enamel is exposed to the ionizing radiation, radicals are formed, which can be detected using Electron Paramagnetic Resonance (EPR) technique. EPR using tooth enamel is based on the correlation between the intensity or amplitude of some of the radiation-induced with the dose absorbed in the enamel. In this study, teeth samples, which were extracted from archaeological site in Nigde, Turkey, were used in the experimental studies. Five animal teeth were selected to obtain an enamel sample formed and then this resultant sample was prepared with combined processes of mechanical and chemical treatment of teeth. This tooth enamel sample was irradiated by 60Co gamma-ray source in dose range of 0-9 kGy at Turkish Atomic Energy Agency (TAEK), ÇNAEM in Istanbul, Turkey and then EPR spectra were recorded by using Bruker EMX X-Band EPR spectrometer between 4K-300K temperatures, in Leibniz Institute for Solid State and Materials Research in Dresden, Germany. Radiation induced paramagnetic centers and radicals in this enamel were investigated and interpreted by obtained X-band EPR results.