EP 11: Astrophysics III: Stellar Astrophysics

Zeit: Freitag 12:30–13:30 Raum: HS 19

EP 11.1 Fr 12:30 HS 19

Membership and rotation of solar- and low-mass stars in the open cluster NGC 3532 — •Dario J. Fritzewski[1], Sydney A. Barnes[1], David J. James[2], and Klaus G. Strassmeier[1] — [1]Leibniz-Institut für Astrophysik Potsdam (AIP), Potsdam, Germany — [2]Harvard-Smithsonian Center for Astrophysics, Cambridge, USA

Stellar rotation periods can be used as an empirical method to determine ages of cool main-sequence stars. By providing coeval (equal-age) populations of the same composition, but varying mass, Galactic open clusters provide an ideal means to construct and test this technique. However, they are often sparse and have incomplete membership lists.

We present the membership for the very populous, 300 Myr-old open cluster NGC 3532 constructed from radial velocity observations and Gaia DR2 proper motions. From photometric time-series observations of the open cluster we determined rotation periods for 200 stars, spanning the range from solar-mass to low-mass stars.

One of the complexities and opportunities in young open clusters is to study a rotational and magnetic transition from fast to slowly rotating stars. The results confirm the rotation-mass-age relation and provide new information about this transition.

EP 11.2 Fr 12:45 HS 19

Force-Free modelling of stellar magnetic fields — •Thomas Wiegelmann[1] and Jörg Büchner[2,1] — [1]MPI für Sonnensystemforschung, Göttingen — [2]Center for Astronomy and Astrophysics, Technical University Berlin

Exo-planets of dwarfs are easy to detect because of their close orbits. For having a habitable zone planets need shielding by a planetary magnetic field. Exo-planetary magnetospheres are shaped and influenced by the magnetic field and wind of their host-star. Therefor it is important to model the large scale structure of stellar magnetic fields, here a fast rotating M-dwarf. The surface magnetic field (intensity and orientation)is measured with Zeeman-Doppler imaging, a tomographic imaging technique. We extrapolate these measurements into stellar coronae with the help of a potential field source surface (PFSS) model and a nonlinear force-free field (NLFFF) model. We find that open field maps and the global magnetic field structure are very different between these models (much more than for solar applications). The investigated dwarfs contain a large amount of free energy which can cause huge flares.

EP 11.3 Fr 13:00 HS 19

Flow patterns and spiral ring structures in the environment of massive stars — •Dieter Nickeler and Michaela Kraus — Astronomical Institute AVCR, Ondrejov, Czech Republic

Observations with modern facilities reveal the presence of structured environments around evolved massive stars (spiral arms, rings, arcs etc.). The dynamics of gas around stars is often modelled by hydrodynamics (HD). Accretion and decretion phenomena, i.e. outflows from stars, are connected with nonlinear flows, today often treated with numerical methods. The classical representation of nonlinear flows has been done already by Euler, Lagrange and Stokes, later by Clebsch and Monge, using vector potentials from which the flow fields can be derived. These potentials, applied to the HD equations, lead to nonlinear Poisson equations, and represent the vortices or the compressibility of the gas. These nonlinear Poisson equations represent an analogy to nonlinear Schroedinger-Eigenvalue or nonlinear diffusion equations, or the equations of nonlinear magnetohydrostatics. Our aim is to extend these equations and involved methods as tools for investigating the circulation and outflow of circumstellar matter around (massive) stars. Preliminary results, as the existence of blow-up solutions and other nonlinear instabilities, are discussed.

EP 11.4 Fr 13:15 HS 19

A new outburst in the Yellow Hypergiant ρ Cas — •Michaela Kraus[1], Indrek Kolka[2], Anna Aret[1,2], and Dieter Horst Nickeler[1] — [1]Astronomical Institute AVCR, Ondrejov, Czech Republic — [2]Tartu Observatory, University of Tartu, Estonia

Yellow hypergiants are evolved massive stars that were suggested to be in post-red supergiant stage. Post-red supergiants that evolve back to the blue, hot side of the Hertzsprung-Russell diagram can intersect a temperature domain in which their atmospheres become unstable against pulsations (the Yellow Void or Yellow Wall), and the stars can experience outbursts with short, but violent mass eruptions. The yellow hypergiant ρ Cas is famous for its historical and recent outbursts, during which the star develops a cool, optically thick wind with a very brief but high mass-loss rate, causing a sudden drop in the light curve. Here we report on a new outburst of ρ Cas which occurred in 2013, accompanied by a temperature decrease of $\sim$3000 K and a brightness drop of 0.6 mag. During the outburst TiO bands appear, together with many low excitation metallic atmospheric lines characteristic for a later spectral type. With this new outburst, it appears that the time interval between individual events decreases, which might indicate that ρ Cas is preparing for a major eruption that could help the star to pass through the Yellow Void.