AGPhil 4: Gravitational and Electromagnetic Waves

Time: Tuesday 14:00–15:45 Location: AGPhil-H14

Invited Talk AGPhil 4.1 Tue 14:00 AGPhil-H14

Hypothetical Waveforms and Unmodeled or Pipeline Searches in Gravitational Wave Astronomy — •Lydia Patton — Virginia Tech, Blacksburg, Virginia, USA

The multiple theoretical and instrumental advances in gravitational wave astronomy (GWA) have allowed for the construction of an increasingly flexible platform for discovery. This paper will investigate novel research methods being constructed on the ground in GWA. It will begin by evaluating the comparison of and contrast between two methods of analysis: the construction of waveforms that incorporate hypothetical parameters for new searches (EOB and novel extended EOB methods), and the use of unmodeled and pipeline-based searches of existing data. In both cases, varying hypothetical assumptions or models allows for more flexible, broad search methods. The question then is how to move from the broader a priori models to the detection of an event. We will examine several recent papers to reconstruct how these broader methods can be used to support novel detection, and examining how search and detection methods work together in this context.

AGPhil 4.2 Tue 14:45 AGPhil-H14

What Gravitational Waves Really Teach Us about Energy — •Samuel Fletcher — University of Minnesota, Twin Cities, Minneapolis, USA

Gravitational wave solutions to the Einstein field equation of general relativity are commonly regarded as examples proving how gravity in general relativity transmits energy from a source body to a distant body. The famous 1955 Feynman sticky bead thought experiment illustrates the reality of this phenomenon by imagining two beads generating heat in a rod on which they slide with friction, due to their changing proper distance in the presence of the waves. I argue that while this lesson is not entirely wrong, it is much too simplistic. It does not reconcile its conclusion with the fact that conservation of local energy-momentum, in the sense that appears in the field equation, prevents energy transmission across a vacuum. Thus "energy transmission" must employ a different concept of energy, raising the possibility of pluralism with regard to the energy concept. Another (compatible) possibility is that gravitational waves, rather than transmitting energy, facilitate the transformation between different types or stores of energy locally. Key to these possibilities is analysis of the Weyl tensor. Time permitting, I discuss these possibilities' implications for a re-evaluation of the scope of Mach's Principle, the idea that the distribution of matter determines the geometry of spacetime.

AGPhil 4.3 Tue 15:15 AGPhil-H14

Absorbing the Arrow of Electromagnetic Radiation — Mario Hubert and •Charles Sebens — California Institute of Technology, Pasadena, CA, USA

We argue that the asymmetry between diverging and converging electromagnetic waves is just one of many asymmetries in observed phenomena that can be explained by a past hypothesis and statistical postulate (together assigning probabilities to different states of matter and field in the early universe). The arrow of electromagnetic radiation is thus absorbed into a broader account of temporal asymmetries in nature. We give an accessible introduction to the problem of explaining the arrow of radiation and compare our preferred strategy for explaining the arrow to three alternatives: (i) modifying the laws of electromagnetism by adding a radiation condition requiring that electromagnetic fields always be attributable to past sources, (ii) removing electromagnetic fields and having particles interact directly with one another through retarded action-at-a-distance, (iii) adopting the Wheeler-Feynman approach and having particles interact directly through half-retarded half-advanced action-at-a-distance. In addition to the asymmetry between diverging and converging waves, we also consider the related asymmetry of radiation reaction.