

## AGPhil 9: History and Philosophy of General Relativity

Time: Thursday 14:00–15:45

Location: HS XVII

**Invited Talk** AGPhil 9.1 Thu 14:00 HS XVII  
**Waves in a turbulent sea: controversies over gravitational waves** — ●HENRIQUE GOMES — University of Oxford, Oxford, UK.

Einstein first claimed gravitational waves would be produced in certain situations within general relativity in 1916. And yet, different parts of that claim were controversial, right up to the discovery of the Hulse-Taylor binary pulsar. In this talk I want to distinguish and give more details about three separate controversies: (1) Are there solutions of the Einstein equations that admit gravitational waves? (2) Can they be produced in systems that are freely-falling? (3) Do gravitational waves carry energy?

Each of these controversies has an interesting history and, even if there are a few holdouts, an interesting resolution.

AGPhil 9.2 Thu 14:45 HS XVII  
**Interpreting the Schwarzschild Metric** — ●DENNIS LEHMKUHL — Lichtenberg Group for History and Philosophy of Physics, University of Bonn

It is sometimes said that the Schwarzschild solution to the Einstein field equations was discovered in 1916 but that it took until the 1950s or 1960s before it was understood that the Schwarzschild metric represents a black hole. Such statements are puzzling, for the Schwarzschild metric was successfully used and applied from its very inception. In this talk, I will trace the history of different applications, interpretations and, intimately linked, coordinatizations of the Schwarzschild metric. The focus will be on a.) Einstein's use of an approximation to

the Schwarzschild metric in the prediction of Mercury's perihelion in 1915 and his subsequent correspondence with Schwarzschild and others on the corresponding exact solution; b.) discussions of what we would today call the event horizon of the Schwarzschild metric during the 1920s; and c.) the development of a conceptual distinction between singularities and horizons in the late 1950s and early 1960s and the resulting new perspective on the Schwarzschild metric.

AGPhil 9.3 Thu 15:15 HS XVII  
**Spacetime Theories Beyond Curvature: Two Incompatible Approaches to Torsion Gravity** — ●KARTIK TIWARI — University of Bonn, Bonn, Germany

Although the standard picture of gravity utilizes a connection between mass-energy distribution and curvature of spacetime, this connection is not unique. Using additional differential geometric concepts (torsion and non-metricity), a relativist can construct various modifications and reformulations of general relativity. Each alternate theory of spacetime is bundled with a blend of attractive and repulsive scientific (or aesthetic) features. In my talk, I discuss two mutually-incompatible frameworks for endowing spacetime with additional geometry. During the first half of the talk, I describe the nature of this incompatibility by comparing the technical foundations of the geometric-trinity paradigm with gauge gravity approaches. In the latter half of the talk, I use Ehlers' work on Frame Theory to re-evaluate the strength of evidence that existing results on the Newton-Cartan limit of Teleparallel Gravity provide.