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The Kavli Foundation Lectureship: The Double Pulsar: A Unique Gravity Laboratory

MICHAEL KRAMER, University of Manchester, Jodrell Bank Centre for Astrophysics

Ever since their discovery, pulsars have been used as precise cosmic clocks. Their observations in binary systems takes us beyond the weak-field regime of the solar-system in the study of theories of gravity. Their contribution is crucial as no test should be considered as complete without probing the strong-field realm of gravitational physics by finding and timing pulsars. This is particularly highlighted by the discovery of the first double pulsar system which is unique in that both neutron stars are detectable as radio pulsars. This, combined with significantly higher mean orbital velocities and accelerations when compared to other binary pulsars, provides the best available testbed for general relativity and alternative theories of gravity in the strong-field regime to date. This review presents the plethora of relativistic phenomena observable in this fascinating system and gives an up-to-date report on its exploitation as a gravity lab.