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John Wheeler, 1952 - 1976: Black Holes and Geometrodynamics

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In 1952 John Wheeler turned his attention from nuclear physics and national defense to a backwater of physics: general relativity. Over the next 25 years, with students and postdocs he led a “revolution” that made relativity a major subfield of fundamental physics and a tool for astrophysics. Wheeler viewed curved spacetime as a nonlinear dynamical entity, to be studied via tools of geometrodynamics (by analogy with electrodynamics) – including numerical relativity, for which his students laid the earliest foundations. With Joseph Weber (his postdoc), he did theoretical work on gravitational waves that helped launch Weber on a career of laying foundations for modern gravitational-wave detectors. Wheeler and his students showed compellingly that massive stars must form black holes; and he gave black holes their name, formulated the theory of their pulsations and stability (with Tullio Regge), and mentored several generations of students in seminal black-hole research (including Jacob Bekenstein’s black-hole entropy). Before the discovery of pulsars, Wheeler identified magnetized, spinning neutron stars as the likely power sources for supernova remnants including the Crab nebula. He identified the Planck length and time as the characteristic scales for the laws of quantum gravity, and formulated the concept of quantum fluctuations of spacetime geometry and quantum foam. With Bryce DeWitt, he defined a quantum wave function on the space of 3-geometries and derived the Wheeler-DeWitt equation that governs it, and its a sum-over-histories action principle. Wheeler was a great inspiration to his colleagues and students, pointing the directions toward fruitful research problems and making intuitive-leap speculations about what lies beyond the frontiers of knowledge. Many of his ideas that sounded crazy at the time were “just crazy enough to be right”.