

APR05-2005-000099

Abstract for an Invited Paper  
for the APR05 Meeting of  
the American Physical Society

### **Einstein, Mach, and the Fortunes of Gravity**

DAVID KAISER, MIT

Early in his life, Albert Einstein considered himself a devoted student of the physicist and philosopher Ernst Mach. Mach's famous critiques of Newton's absolute space and time – most notably Mach's explanation of Newton's bucket experiment – held a strong sway over Einstein as he struggled to formulate general relativity. Einstein was convinced that his emerging theory of gravity should be consistent with Mach's principle, which states that local inertial effects arise due to gravitational interactions with distant matter. Once completed, Einstein's general relativity enjoyed two decades of worldwide attention, only to fall out of physicists' interest during the 1930s and 1940s, when topics like nuclear physics claimed center stage. Gravity began to return to the limelight during the 1950s and especially the 1960s, and once again Mach proved to be a major spur: Princeton physicists Carl Brans and Robert Dicke introduced a rival theory of gravity in 1961 which they argued satisfied Mach's principle better than Einstein's general relativity did. The Brans-Dicke theory, and the new generation of experiments designed to test its predictions against those of general relativity, played a major role in bringing Einstein's beloved topic back to the center of physics.