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Effects of Gravity on Dense Nonrelativistic Axions[1] ERIC BRAATEN, ABHISHEK MOHAPATRA, Ohio State University, HONG ZHANG, Technical University Munich — Previous studies of dense gravitating systems of axions (or any bosons described by a real scalar field) have assumed that the effects of gravity are produced by the gravitational potential whose source is the energy density of the bosons. However the oscillations of a real scalar field necessarily produces a pressure that is instantaneously comparable in magnitude to the energy density, although its average over an oscillation period may be much smaller. When the pressure is taken into account in Einstein's equation in the weak gravity limit, the effects of gravity are produced by two gravity potentials, one whose source is the energy density and the other whose source is the pressure. The pressure may have a significant effect on dense gravitating systems of nonrelativistic bosons, such as a collapsing dilute axion star or a dense axion star.

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