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**Quantum many-body system based on phonons and donors in silicon**  
Ö. O. SOYKAL, CHARLES TAHAN, Laboratory for Physical Sciences, College Park, MD — Cold atoms in optical lattices have become an indispensable tool for the study of many-body physics. Here, we introduce a novel many-body quantum system based on phonons with potentially useful properties. Theoretical results will be presented on the possibility of interacting systems based on phonitons, hybrid composite objects of a matter excitation and a cavity phonon. We discuss experimentally accessible regimes in silicon phoniton systems involving Mott insulator and superfluid phases. We consider experimental tools to probe these many-body states and give explicit designs for devices where they can be observed.

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