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Ultracold Neutron Source Technology: Status in 2012

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We present an overview of the state of the art for ultracold neutron (UCN) sources. Driven by the need for increased UCN density for fundamental physics experiments, there has been a signficant growth in the number and variety of UCN sources either planned or in operation over the past decade. All of these new sources rely either on solid deuterium or superfluid helium converters to produce UCN, so we review the basic principles of UCN production and identify common challenges in extracting useful UCN. Methods for producing the primary neutron flux and premoderating neutrons to optimize the UCN output from the solid deuterium or superfluid He vary, however, with most of these sources taking a unique strategy towards meeting the technological challenge of reaching high useful UCN densities. We survey existing and planned sources, highlighting the achievements of those already operational and the prospects for increased UCN density in each case. We also identify some promising technologies which may provide further gains in UCN production and density in future sources.