Low-lying level structure of light neutron-rich nuclei beyond the dripline: ^{7,9}He and ^{10}Li

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The very neutron-rich light nuclei provide a fertile testing ground for our understanding of nuclear structure. The resonances in unbound neutron-rich light nuclei are expected to provide important constraints on our understanding of evolution of nuclear shell structure and nuclear binding. Experimentally, this region offers our only practical possibility for detailed spectroscopy of nuclei beyond the neutron dripline. Theoretically, the very light neutron-rich nuclei are capable of being described using ab initio models. In addition, recent advanced shell model approaches, such as, the shell model in the continuum, and the no-core shell model are capable of providing predictions in this region. Therefore, experimental information on them will prove to be useful in forming a complete view of nuclear structure. In addition, the structure of some unbound systems, such as ^{10}Li, is key to constructing three-body descriptions of two-neutron halo nuclei.

One of the tools most well adapted to the study of nuclei far from stability is that of "knockout" or breakup of a high-energy radioactive beam. Following a brief description of the technique, two specific topics related to the spectroscopy of light unbound systems will be discussed:

- A search for the putative low-lying $1/2^-$ spin-orbit partner of the ^{7}He$(3/2^-)$ ground state.
- An investigation of the parity inversion in the $N = 7$ isotones ^{9}He and ^{10}Li.

The talk will conclude with some comments on the need to investigate more fully the structure of ^{9}He and ^{10}Li, and possible future low-energy experiments that could be pursued at TRIUMF.