AB INITIO GROUND AND EXCITED STATES FOR ALL *SD*- AND *PF*-SHELL NUCLEI

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<Recent advances in ab initio nuclear structure theory have led to groundbreaking predictions in the exotic medium-mass region, from the location of the neutron dripline to the emergence of new magic numbers far from stability. Playing a key role in this progress has been the development of powerful many-body techniques and chiral effective field theory, which provides a systematic basis for consistent many-nucleon forces and electroweak currents.

Within the context of valence-space Hamiltonians derived nonperturbatively from the in-medium similarity renormalization group (IM-SRG) approach, I will discuss a novel targeted-valence-space implementation, which allows for an approximate treatment of 3N forces between valence nucleons. I will show that ground-state energies are obtained to a similar level of accuracy as in large-space ab initio methods, such as coupled-cluster theory, thereby extending the reach of ab initio calculations of ground and excited states to *all* nuclei through the *sd*- and *pf*-shell regions. Finally, this approach provides the first ab initio solution of the $3^+/1^+$ ground-state inversion puzzle in ^{22}Na and ^{46}V, analogous to the famous ^{10}B problem in the *p* shell. >