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Magicity vs Superfluidity: Neutron correlations in the heavy F isotopes (online)

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Nuclear structure evolves dramatically in asymmetric systems, particularly near the drip lines. A notable example is the "Island of Inversion", where the magic neutron number N=20 breaks down, as established for proton number Z=10-13. We study the structure of the most neutron-rich Fluorine (Z=9) isotopes around N=20 using the SAMURAI spectrometer at RIBF/RIKEN. Measurements were performed in inverse and complete kinematics with radioactive-ion beams at ~250 MeV/u incident on a LH2 target. The first measurement of the neutron-unbound 30F isotope via the invariant mass method confirms the breakdown of the N=20 magic number, thus extending the "Island of Inversion", with significant consequences for the F and O iostopes. Large-scale shell model calculations suggest that ^{29}F and ^{28}O are superfluid nuclei where neutron pairs scatter between shells, potentially transitioning into a BEC-like regime with small size pairs. Future experiments are being developed to further investigate these correlations.

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