Spectroscopy along Decay Chains of Element 114, Flerovium

In the wake of the discovery of superheavy elements, nuclear spectroscopy experiments aim at providing anchor points at the uppermost end of the nuclear chart for nuclear structure theory, which otherwise had to solely rely on extrapolations. In two runs in 2019 and 2020, such a nuclear spectroscopy experiment was conducted to study α-decay chains stemming from isotopes of flerovium (element Z = 114).

The U310 experiment conducted at the GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany, employed an upgraded TASISpec decay station placed behind the gas-filled separator TASCA. The fusion-evaporation reactions ^{48}Ca+^{242}Pu and ^{48}Ca+^{244}Pu provided a total of 32 flerovium-candidate decay chains in effectively 18 days of beam time. Two and eleven decay chains were firmly assigned to even-even ^{286}Fl and ^{288}Fl isotopes, respectively. The – admittedly unexpected – observations include (i) an excited 0^+ state at 0.62(4) MeV excitation energy in ^{282}Cn, and (ii) a Q_α = 9.46(1) MeV decay branch (1 out of 51) from ^{284}Cn into ^{280}Ds [1]. Both observations indicate that there is hardly any shell gap at proton number Z = 114 - at least not at neutron numbers N ≈ 172-174. The remaining decay chains stemming from ^{289}Fl indicate the presence of α-decay fine structure as has been theoretically predicted for odd-A Fl-decay chains. This is the focus of an ongoing analysis [2].

[1] A. Såmark-Roth *et al.*, Phys. Rev. Lett., 126, 032503 (2021).
[2] D.M. Cox *et al.*, to be submitted to Phys. Rev. Lett.