Classification of finite groups all of whose Haar graphs are Cayley graphs

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A Cayley graph of a group H is a finite simple graph Γ such that $\mathrm{Aut}(\Gamma)$ contains a subgroup isomorphic to H acting regularly on $V(\Gamma)$, while a Haar graph of H is a finite simple bipartite graph Σ such that $\mathrm{Aut}(\Sigma)$ contains a subgroup isomorphic to H acting semiregularly on $V(\Sigma)$ and the H-orbits are equal to the bipartite sets of Σ. It is well known that each finite abelian group H has the property that every Haar graph of H is a Cayley graph. In this paper, we classify finite non-abelian groups with the property that all of whose Haar graphs are Cayley graphs, which answers an open problem posed by Estélyi and Pisanski (2016). This is joint work with Yan-Quan Feng, István Kovács, and Jie Wang.