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The intersection density of transitive groups of degree $3p$

Given a finite transitive group $G \leq \mathrm{Sym}(\Omega)$, a subset $\mathcal{F} \subset G$ is *intersecting* if for any $g, h \in G$, there exists $\omega \in \Omega$ such that $\omega^g = \omega^h$. The *intersection density* of G is the rational number

$$\rho(G) := \max\left\{ \frac{|\mathcal{F}|}{|G|/|\Omega|} : \mathcal{F} \subset G \text{ is intersecting} \right\}.$$

In 2022, Meagher asked whether $\rho(G) \in \left\{1, \frac{3}{2}, 3\right\}$ for any transitive group $G \leq \mathrm{Sym}(\Omega)$ of degree $|\Omega| = 3p$, where $p \geq 5$ is an odd prime. Except for the cases where $p = q+1$ is a Fermat prime and Ω admits a unique G-invariant partition $\mathcal{B}$, whose blocks are of size 3, such that the induced action of G on $\mathcal{B}$ is isomorphic to $\mathrm{PSL}_2(q)$, I will answer Meagher's question positively for imprimitive groups admitting a normal block system.

Joint work with Roghayeh Maleki.