

Say  $CG \sim M_{n_1}(\mathbb{C}) \times \cdots \times M_{n_r}(\mathbb{C})$ , with  $n_1 = 1$ . Then  $n_1^2 + \cdots + n_r^2 = |G| = p^2$ .

But, each  $n_i \leq p$ . This clearly implies that each  $n_i = 1$ . In particular,  $CG \sim \mathbb{C} \times \cdots \times \mathbb{C}$ , so  $G$  is abelian.