A primitive C^*-algebra A acting on a Hilbert space H such that $A \cap A' = \{0\}$ (A' is the commutant of A in $B(H)$).

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Let H be an infinite dimensional Hilbert space, then $K(H)$ is primitive, since the identity representation

$$\begin{aligned} K(H) &\longrightarrow B(H) \\ T &\longmapsto T \end{aligned}$$

is faithful irreducible (if $T \in K(H)'$, then for each x in H, $T(x\overline{\otimes}x) = (x\overline{\otimes}x)T$. So $Tx\overline{\otimes}x = x\overline{\otimes}T^*(x)$. Hence $< x, x > Tx =< x, T^*x > x$. So $Tx = \lambda(x)x$ for some $\lambda(x) \in \mathcal{C}$. For linearly independent vectors x and y, $\lambda(x+y)(x+y) = T(x+y) = Tx + Ty = \lambda(x)x + \lambda(y)y$. So $\lambda(x+y) = \lambda(x) = \lambda(y)$. Hence for each e in an orthonormal basis E of H, $\lambda(e) = \lambda(e_0)$, where e_0 is an arbitrary fixed element of E. Therefore $Tx = T(\sum_{e\in E} \mu_e e) = \sum_{e\in E} \mu_e \lambda(e_0)e = \lambda(e_0)x$. So $T = \lambda(e_0)I_H$. Thus $K(H)' \subseteq \mathcal{C}I_H$. Obviously $\mathcal{C}I_H \subseteq K(H)'$. So $K(H)' = \mathcal{C}I_H$). But $I_H \notin K(H)$. So $K(H) \cap (K(H))' = \{0\}$.

Note that for x and y in H the rank one operator $x\overline{\otimes}y$ is defined by

$$(x\overline{\otimes}y)(z) =< z, y > x.$$