

# A NEW TYPE OF NONCOMMUTATIVE POSITIVSTELLENSATZ

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We study non-commutative real algebraic geometry for a unital associative  $*$ -algebra  $\mathcal{A}$  viewing the points as pairs  $(\pi, v)$  where  $\pi$  is  $*$ -representation of  $\mathcal{A}$  on a pre-Hilbert space which contains the vector  $v$ . These general results are illustrated in the cases where  $\mathcal{A}$  is one of the following  $*$ -algebras:  $M_n(\mathbb{R})$ ,  $M_n(\mathbb{R}[X_1, \dots, X_d])$  and the free  $*$ -algebra in  $d$  variables.

For comparison, non-commutative real algebraic geometry where the points are  $*$ -representation of  $\mathcal{A}$  — an approach of K. Schmüdgen — is well developed.