1106-03-1681 **Eduardo Dueñez*** (eduenez@utsa.edu), Mathematics Department, The University of Texas at San Antonio, San Antonio, TX 78249-0664, and **José Iovino** (jose.iovino@utsa.edu), Mathematics Department, The University of Texas at San Antonio, San Antonio, TX 78249-0664.
Model theory and the Mean Ergodic Theorem for abelian unitary actions.

Let T be a unitary transformation of a Hilbert space $\mathcal{H}$. Von Neumann's Mean Ergodic Theorem (1932) states that the ergodic averages

$$\mathrm{AV_n}(x) := \frac{1}{n} \lim_{n\to\infty} \sum_{k=1}^{n} T^n(x)$$

as $n \to \infty$, tend, for each $x \in \mathcal{H}$, to the projection $\pi(x)$ of x on the subspace ${}^T\mathcal{H} = \{x \in \mathcal{H} \mid T(x) = x\}$ of fixed elements.

T. Tao (2012, unpublished) has outlined a short proof of the existence of the averages using classical nonstandard analysis *à la* Robinson. Using the theory of types over Banach structures, we prove Wiener's 1939 generalization of von Neumann's theorem (for ergodic averages of a unitary representation of an abelian group G on $\mathcal{H}$). Our approach is close to Tao's in spirit, but the use of model-theoretical types captures subtleties easily missed in Robinson's formalism; in particular, our argument requires quantified types as well as types in two variables, and also exploits homogeneity.

We hope to extend these results to obtain a model-theoretical proof of the theorem of M. Walsh (2012) on polynomial ergodic averages. (Received September 15, 2014)