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**Alan Haynes\*** (haynes@math.uh.edu) and **Jens Marklof**. *Higher dimensional Steinhaus and Slater problems via homogeneous dynamics.*

The three gap theorem, also known as Steinhaus conjecture or three distance theorem, states that the gaps in the fractional parts of  $\alpha, 2\alpha, \dots, N\alpha$  take at most three distinct values. Motivated by a question of Erdős, Geelen and Simpson, we explore a higher-dimensional variant, which asks for the number of gaps between the fractional parts of a linear form. Using the ergodic properties of the diagonal action on the space of lattices, we prove that for almost all parameter values the number of distinct gaps in the higher dimensional problem is unbounded. Our results in particular improve earlier work by Boshernitzan, Dyson and Bleher et al. We furthermore discuss a close link with the Littlewood conjecture in multiplicative Diophantine approximation. Finally, we also demonstrate how our methods can be adapted to obtain similar results for gaps between return times of translations to shrinking regions on higher dimensional tori. (Received August 22, 2017)