

## Structural Questions in $\mathbb{Q}^3$ and $\mathbb{Z}^3$ That Both Delight and Mystify Me

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The central idea of this talk will be that of the Euclidean distance graph. For  $\mathbf{X} \subset \mathbb{R}^n$  and  $d > 0$ , denote by  $G(\mathbf{X}, d)$  the graph with vertex set  $\mathbf{X}$  where any two vertices are adjacent if and only if they are a Euclidean distance  $d$  apart. Much has been said about chromatic numbers of such graphs, and I too will say my part, mostly in giving a summary of what is currently known. The main focus, however, will be on structural properties of  $G(\mathbb{Q}^3, d)$  and  $G(\mathbb{Z}^3, d)$  – in particular, the presence (or lack thereof) of certain cycles in the graphs. Along the way, I will give a useful (perhaps?) characterization of isosceles triangles with vertices in  $\mathbb{Q}^3$  and present an interesting (maybe?) integer sequence arising from this work.