Math Review to the paper *M. Atapour, C. E. Soteros, D. W. Sumners and S. G. Whittington, 'Counting closed 2-manifolds in tubes in hypercubic lattices', Journal of Physics A: Mathematical and Theoretical, 48 (2015).*

This is a paper on pure mathematics (geometry and topology) motivated by physics. The authors study asymptotic behavior of closed connected 2-manifolds in the union of 2-dimensional faces of the standard cubic lattice in d-dimensional Euclidean space R^d.

E.g. for each $d \geq 3$ and L there are $\alpha, \lambda > 0$ such that the number of polyhedral spheres

- formed by n two-dimensional faces of the standard cubic lattice in R^d,
- whose vertices satisfy inequalities $x_1 \geq 0, \quad 0 \leq x_2 \leq L, \quad \dots, \quad 0 \leq x_d \leq L$,
- who have a vertex for which $x_1 = 0$,

is asymptotically equivalent to $\alpha\lambda^n$ (Theorem 4).

Same result (with different α, λ) holds for 'polyhedral spheres' replaced by 'closed connected 2-dimensional manifolds' (Theorem 5).

The authors also show that

- manifolds with any fixed genus,
- orientable manifolds for $d \geq 4$, and
- unknotted manifolds

are exponentially rare (Theorems 6-9).

The statements and proofs are not up to mathematical standards, so there appears an interesting task of writing rigorous statements and proofs.