Open Problem 10.2 *Prove or disprove: With high probability the SDP relaxation* (105) *is tight as long as* $\sigma = \tilde{\mathcal{O}}(n^{1/2})$. *This would follow from showing that, with high probability* $\|Wx^\natural\|_\infty = \tilde{\mathcal{O}}(n^{1/2})$, *where* $x^\natural$ *is the optimal solution to* (103).

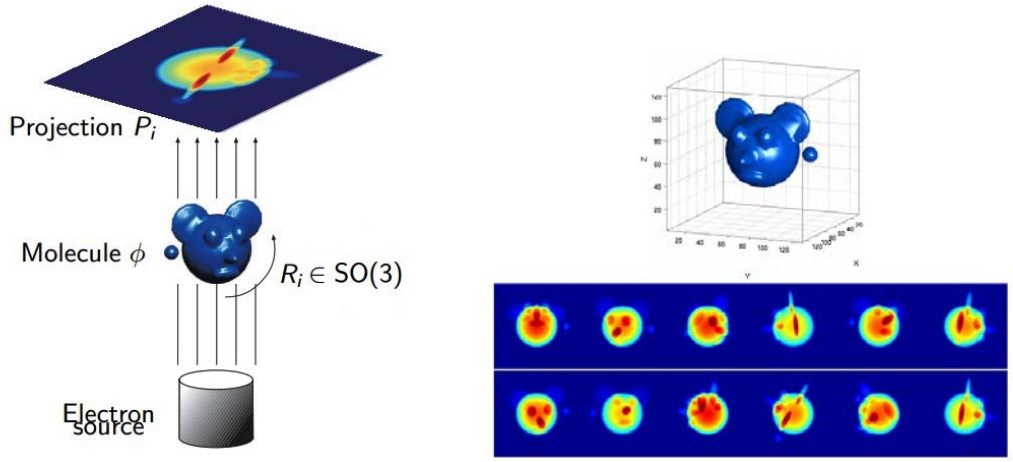

Image courtesy of Prof. Amit Singer, Princeton University. Used with permission.

Figure 24: Illustration of the Cryo-EM imaging process: A molecule is imaged after being frozen at a random (unknown) rotation and a tomographic 2-dimensional projection is captured. Given a number of tomographic projections taken at unknown rotations, we are interested in determining such rotations with the objective of reconstructing the molecule density. Images courtesy of Amit Singer and Yoel Shkolnisky [SS11].

We note that the main difficulty seems to come from the fact that W and $x^\natural$ are not independent random variables.

Reference

[SS11] A. Singer and Y. Shkolnisky. Three-dimensional structure determination from common lines in Cryo-EM by eigenvectors and semidefinite programming. *SIAM J. Imaging Sciences*, 4(2):543–572, 2011.

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