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Comment on article by van Dyk et al.

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We congratulate the authors on a clear and well-written paper. They used highly structured complex models that were nevertheless flexible to analyze large, complex datasets. We offer several comments.

1. The Poisson model used throughout the paper is sensible for the physical aspect of the problem. However, the Poisson distribution lacks a variance parameter. Overdispersion might arise from, say, inaccurate modeling of the point spread function; similar issues arose from applying these models to tomography data (Gelman 1990; Gelman et al. 1996). If overdispersion is present, the posterior uncertainties may be understated, and so cast doubt on the interpretations of the significance maps in Figure 13, for example.

   It will be reassuring to have a model that allows for overdispersion, or a test to show that overdispersion is not a problem for the data.

2. Since the models used are so complex, it will be helpful to have posterior simulations of replicated data sets alongside the actual data. This will be useful for both the reconstruction of NGC 6240 (Figure 13) and the spectrum of Capella (Figure 16). One can then check that the general patterns in the actual data are also present in the replicated data sets. This will help in finding problems with or building confidence in the model.

3. We have a question about the multiscale model shown in Figure 7. The quadrant divisions in the model should produce boundary effects, but are not present in the reconstructions. Perhaps it would be helpful to see some images simulated from the prior distribution, to get a sense of what this model is doing.

4. In describing kernel smoothing methods, the authors write, "Although such ad hoc smoothing routines can produce beautiful images, it is difficult to identify their inherent model assumptions, to quantify their fitting errors, or to assess their reliability." We would like to note that there has been some work studying the theoretical properties of smoothed estimates (see Silverman et al. 1990; Gelman 1996, section 4).

5. In comparing the reconstruction of NGC 6240 using spatial smoothing to the Bayesian reconstruction, the authors note that the smoothed reconstruction missed a loop in the upper right of the image that the Bayesian reconstruction captured. On the other hand, we find three bright, but separate point sources near the center

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