Project Details

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Project Title:
Seismic Study of the Solar Subsurface based on Robust Time-Distance Inferences

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Summary:
I propose a 3 year program to develop, refine and strengthen the analysis methods needed to provide robust and reliable diagnostic methodology for the solar sub-surface using time-distance analysis. I propose to continue and expand the work done in time-distance analysis at the Smithsonian Astrophysical Observatory (SAO). The proposed work will focus on both data analysis -i.e. the computation of time anomalies- and on inversion techniques for structure and dynamics, in quiet and active regions. The focus of the work proposed at SAO will be aimed at the error analysis and the trade-off between precision and resolution. Error estimates for time anomalies are a key ingredient to adequately scale the inverse problem as well as to properly assess the uncertainty and the resolution of inversion inferences. Surprisingly most results in time-distances have ignored this key aspect of the analysis. Additional work in inverse techniques is also proposed. On one hand, additional simulations can and will help us establish the observational precision and resolution needed to extract credible information. On the other, there is a need to continue developing the forward model, especially in terms of adequate kernels. Finally, in order to invert velocity flows that are consistent with basic physical principles we must find an effective way to include a mass conservation constraint. Our current implementation is only a first step in that direction. I thus propose to contribute to the development of a robust Time-Distance data analysis and inversion methodology. It will allow us to better characterize the actual diagnostic potential of the method and to better understand the bias in the inferred solutions introduced by the topology of the associated anihilator, while addressing the issue of trade-off between resolution (in time and space) and error magnification. Such development of time-distance analysis techniques is a key element to ensure the full scientific return of the Helioseismic and Magnetic Imager that will fly on board the Solar Dynamics Observatory, a key mission of the Living with a Star initiative.

Publication References:

Summary: "

Reference: Korzennik, Sylvain SAO - Seismic Study of the Solar Subsurface based on Robust Time-Distance Inferences