ISSI Bern 2019

All AI due dates are for the Saclay fall meeting

Attendance: TA, TC, JWL, RK, JCD, AMB, WJC, TS, KB, GB, YL, BA, AS Webex: HS Excused: RAG

| Monday 11 March 2019 | |
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| Talk by Joergen (solar models) Upper boundary condition: all identical (YL). No effect of surface on g-mode frequencies. | |
| d_l vs s_l (Elsworth et al, 1990, Nature 347, 536). Not affected by surface perturbation (AS). | |
| Kernel for the slope (AI 01). Slope depends on high order modes affected by surface effects. Make a comparison using the ratio | AI 01 on JCD |
| instead getting rid of the surface effect (AI 02). Need to study the impact of the surface on the slope (AI 03 on JCD). Need when fitting the slope to use the observational weights also for the | AI 02 on JCD / AS AI 03 on JCD |
| theory (AI on 04). | AI 04 on JCD |
| Talk by Gaël (solar models) Entropy proxy S=P/ρ^(5/3) | |
| Talk by Aldo (neutrino) Borexino and neutrino spectrum published in 2018 in Nature. Comparison of JCD solar models with neutrino fluxes (AI 05). | AI 05 on JCD |
| Lower metallicity implies higher opacities to keep the neutrino fluxes (higher core temperature). The values constrained by Borexino is 1530 sec for P_1 (1500-1560 p-p) or P_0 =36.06 ± 0.24 minutes (See the slides by TA). | |
| Talk by Gaël (inversion) Get P ₀ from p modes constraint (AI 06) Derive kernels for period spacing (AI 07) | AI 06 on GB AI 07 on GB |
| Tuesday 12 March 2019 | |
| Report on AIS from JCD s_1 is now in agreement with the new frequencies (BiSON) after also applying the observed weights to the theoretical model. Kernels for s_1 shown (see updated presentation by JCD) | AI 01, 02 and 04 closed! |
| Talk by KévinB (excitation and amplitude) Fit p modes data from new times series for comaring p-mode | |

| energy (AI 08). Low order g modes damping is very uncertain. Up to 0.03 cm/s in the radiative zone for g modes (Alvan et al, 2005). Low Péclet number injects more energy in the g modes in | AI 08 on TA |
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| is Γ divided by 2π . Limit for 22 years (AI 09). S/N=0.3 detection of excess power possible like it is done for the stellar p modes (AI 10). Question from Hannah: any thoughts on how interaction / coupling with g-modes would affect amplitudes / line widths of p-modes in the Sun? Direct coupling is very small. | AI 09 on TA AI 10 on WJC |
| Talk by ThierryC (asymptotic g modes) Takata paper without Cowling on asymptotic approximation of g- mode periods (need reference, AI 11) | AI 11 on KB |
| Wednesday 13 March 2019 Talk by Hannah (work on Fossat et al., 2017, aka F17) Start and cadence change the maximum. Periodicity at the cadence. Test with no overlapped data as well. Detection is still "fragile" not to say "inexistent" | |
| Talk by Takashi (work of Scherrer and Gough on F17 and Fossat and Schmider, 2018, aka FS18) Discussion on the eveness of the A9 equation after ThierryC remarks. Takashi did the maths and found a typo which was confirmed by Douglas Gough later on. In A9 only even degree modes perturb the p modes. | |
| Talk by ThierryA (work on F17 and FS18) Paper with ThierryC now accepted and as a forecoming paper in A&A (also on Arxiv) | |
| Talk by Anne-Marie (coincidence search) Shift by 24 h reduce coherence to zero in the noise, and reduce coherence in the p-mode range by a factor 2. Using color noise for statistics. | |
| Talk by ThierryA (g-mode collapsogramme) | |
| Open discussion Second ISSI meeting anticipated in the April-June 2020 time frame (AI 12, doodle poll) | AI 12 on TA |
| List of available data set: GONG data <i>l</i> =1 to 6 (25 y) / BiSON (29 y) / SPM / LOI data (22 y). Put them on line (AI 13) | AI 13 on TA |
| GOLF data properly calibrated and instrumental correction (use proper timing correction from Appourchaux et al., 2018 and homogenous p-mode amplitude). AI 14 | AI 14 on RAG |
| MDI/HMI get vwv (AI 15on JWL/HS) <i>l</i> =1 to 6 (30) | AI 15 on JWL/HS |

| g-mode frequency shift from Mag. field change at base of convection zone (AI 16). Solved during the meeting but report due. | AI 16 on RK |
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| Solar structure reconstructed from p modes and neutrino (AI 17) GB/AS) | AI 17 on GB / AS |
| g-mode collapsogramme for several models folding in rotation splittings (AI 18) | AI 18 on TA |
| Put g-mode frequency on web page (AI 19) | AI 19 on TA |
| Coincidence search on new data sets (AI 20) | AI 20 on AMB |
| Discussion on the Saclay meeting Fall 2019. Use to widen the community beyond the ISSI team. Report on rotation inversion (MJT initiative). Two talks by Rafa on GOLF-NG + reanalysis of Garcia et al (2007). Reports from AIs of March 2019. Duration is 3 days. | |
| Video meeting beginning of July 2019 (AI 2/ set doodle poll) | AI 21 on TA |
| Discussion on synthetic data Power spectra with frequencies (some amplitudes) Use existing LC for putting g-mode signal (GOLF, BiSON, MDI, etc) | |
| Use theoretical amplitudes / lifetime for making synthetic data (interpolate amplitude to best model frequencies) (AI 22) | AI 22 on WJC |
| Use imaging instrument for getting synthetic data (AI 23, JWL should express better this AIdo the write up) | AI 23 on JWL |
| Test RAG2007 detection scheme with synthetic data and a theoretical model (unknown) | |
| Thursday 14 March 2019 Talk by Bill (BiSON-NG) Bill says we should work to produce updated predictions, using different assumptions on the underlying g mode signal (can try extreme cases) and different types of observations (continued current data, new data etc., folding in leveraging spatial incoherence of solar BG with height and spatial location across surface) John: need "3D" data to include depth dependence of signal in atmosphere. | |

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| Different observational perspectives to beat down solar noise, including space missions and different sites on Earth (different line-of-sight velocity). Need to demonstrate that you really do gain by sampling signals at different heights in the atmosphere; do back-of-envelope calculations using assumptions on spatial coherence of solar noise with height and location across surface; René mentions an instrument Markus Roth is working on. | |
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| Kevin comments on variations of signal with colatitude on surface; previous work on this, see https://iopscience.iop.org/article/10.1086/374302/pdf | |
| Joergen: At some point some discussion on whether S/N might be higher in photometry than in Doppler velocity; can one use one signal to predict in another (cf. Suzanne Aiggrain's work on using photometry to predict Doppler signal from activity for exoplanet detection) | |
| Kevin: theoretical predictions, major uncertainty in turbulent velocities at base of CZ; suggests doing local simulations including penetrative convection to get handle on velocities; Mark Rast has been working on what may be relevant simulations in Boulder. | |
| Bill & Takashi mention Tom Duvall attempting to use "deep focussing" to detect g modes | |
| Kevin's view is asymptotic g-mode lifetimes are likely OK (if radiative damping is dominant mechanism) (See AI 16) | |
| Kevin: "lucky amplifier" or "synchronous detection" method: http://www.mouser.com/pdfdocs/ADI_Use-Synchronous- Detection-to-Make-Precision-Low-Level-Measurements-MS- 2698.pdf. Comment from TA: nothing is new here. Was tried after the paper of Thomson et al (1995) but does not work if modes are missed. | |
| Friday 15 March 2019 List of AI and minutes from the meeting (AI 24) | AI 24 on TA |
| Papers on: g-mode frequency comparison (including "B" effect) impact of Borexino constraints Kernels for s_l Parametric rotation study of the rotational kernels for g-mode frequency (and change with the models + extreme statistics) | |

| Make avail. observational and synthetic data sets (Use Warrick's | |
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| synthetic data, need to read to see if this is pertinent, AI 25) | AI 25 on TA |
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| Make recipe for synthetic data sets | |
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| Discussion on HH exercise | |
| Hares: (Gaël / Aldo / Joergen / Bill) | |
| – Phase I: to produce synthetic data for several unknown models | |
| (including rotation) at the limit of detection | |
| – Phase II: same as Phase I but with clear detection (after the | |
| Hounds are bored) | |
| Time frame to be known by April 1st (AI 26, set dead line) | AI 26 on GB |
| Hounds: (Rafa / TA / TC / AMB / René) | |