

# Fireslide 1

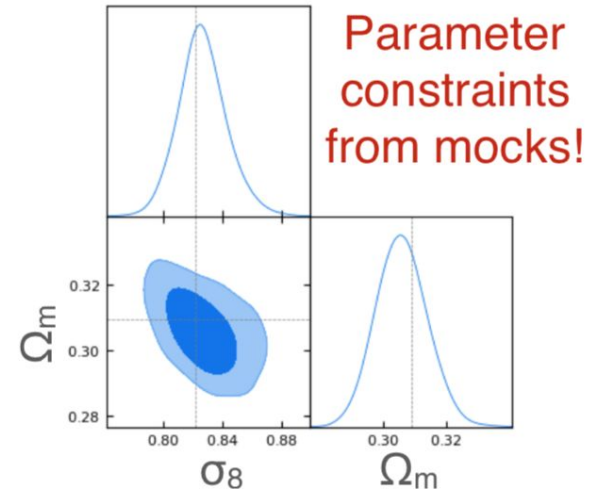
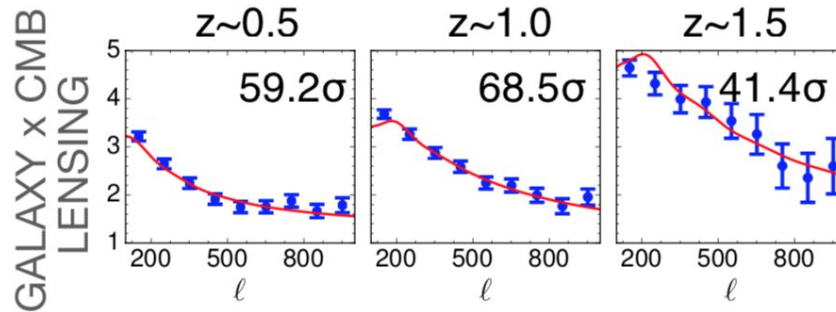
Tuesday, March 9



Alex Krolewski

Waterloo/Perimeter

## CMB LENSING CROSS-CORRELATIONS



- unWISE x Planck:  $S/N \sim 80$ , implies  $\sim 1.5\%$  measurement of amplitude of power spectrum: address lensing tension, constrain modified gravity?
- Other interests: tSZ and quasars; cross-correlation redshifts; ISW

# *New sky models for PySM 3*

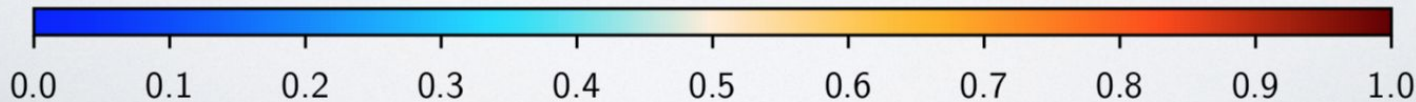
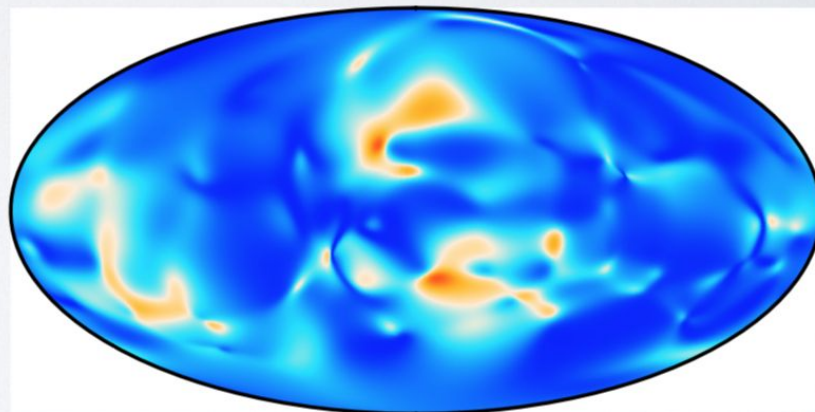
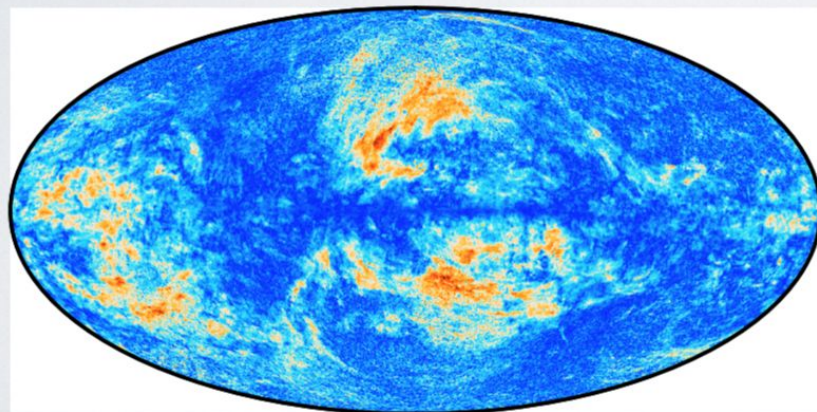
by **Andrea Zonca**

- Galactic dust templates
  - Based on Planck GNILC maps (no CIB contamination)
  - Small scales added to polarization fraction tensor
  - Anti-transformed templates have non-gaussianity
  - <https://github.com/healpy/pysm/pull/72>
- Working on other galactic models
- Next more realistic multi-layer models
- Join in at the Pan-Experiment Galactic Science Group telecon, see Brandon Hensley's fireslide

# ANDREI FROLOV (SFU)

Modelling polarized dust foregrounds

$$I = \int S_\nu e^{-\tau_\nu} d\tau_\nu \left[ 1 - p_0 \left( \cos^2 \gamma - \frac{2}{3} \right) \right], \quad \begin{Bmatrix} Q \\ U \end{Bmatrix} = \int S_\nu e^{-\tau_\nu} d\tau_\nu \begin{Bmatrix} \cos 2\psi \\ \sin 2\psi \end{Bmatrix} p_0 \cos^2 \gamma$$





# Anna Y. Q. Ho (Miller Fellow, UC Berkeley / LBL)

**Relativistic  
explosions**

**Gamma-ray  
bursts**

**Mass-loss in  
massive stars**

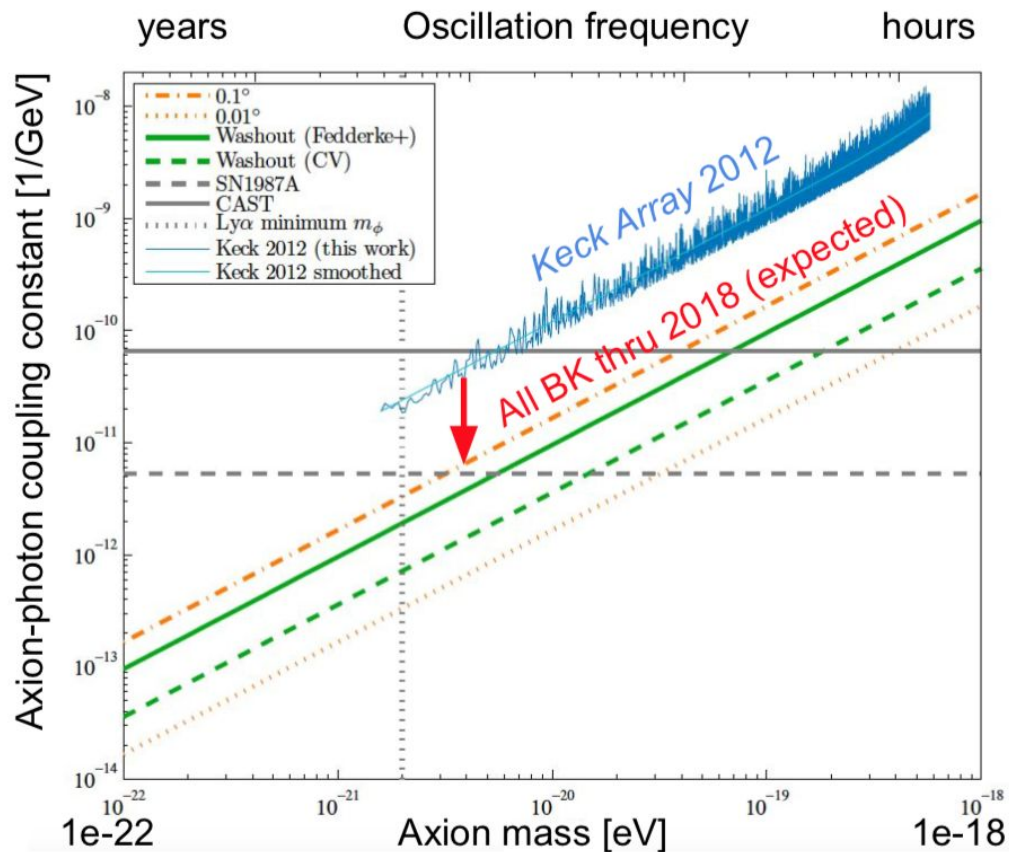
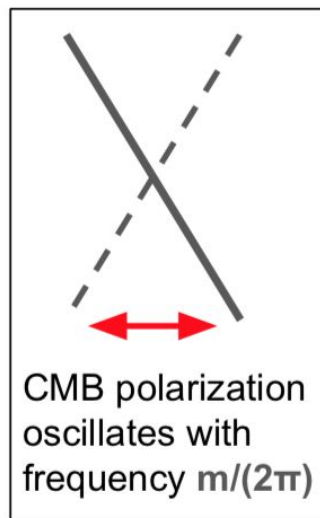
**Luminous, long-lived millimeter  
transients (ALMA, NOEMA, SMA)**

# Axion direct detection with CMB polarimeters

Local axion-like dark matter produces  
**time-variable global polarization rotation**  
(Fedderke+, 2019)

First demonstration:  
BICEP/Keck XII, 2021  
(arXiv:2011.03483)

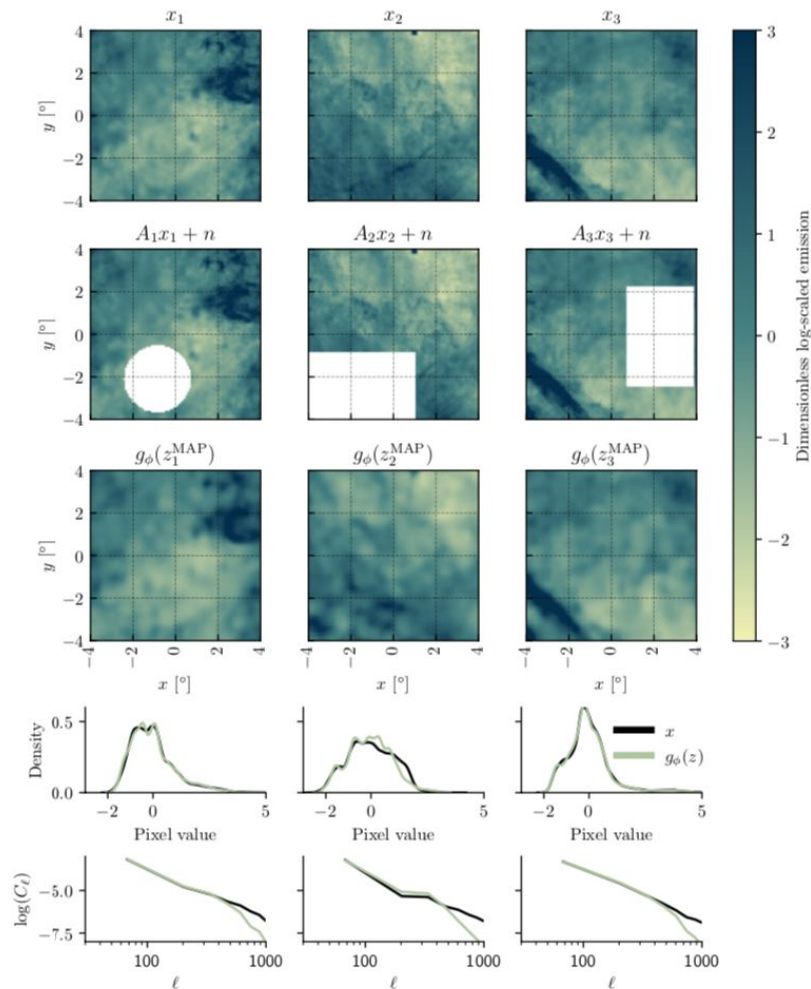
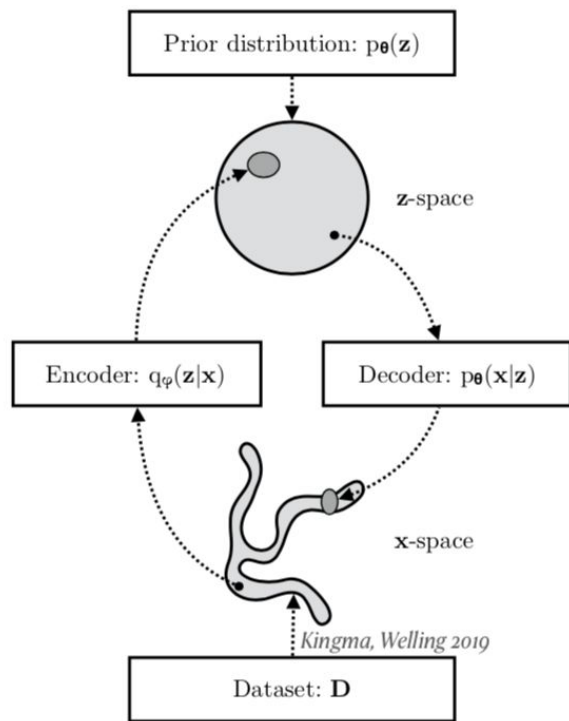
**Free science for  
CMB polarimeters**



# A generative model of Galactic foregrounds using variational inference

Thorne, Knox & Prabhu, 2021, [arXiv: 2101.11181](https://arxiv.org/abs/2101.11181)

Learn the joint distribution of dust images and set of latent variables:  $p(\mathbf{x}, \mathbf{z}) = p(\mathbf{x} | \mathbf{z})p(\mathbf{z})$ . We can use this distribution in various Bayesian analysis tasks, for example image reconstruction, inference, or novel image generation.





# Pan-Experiment Galactic Science Group

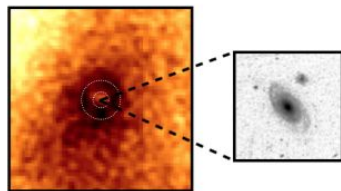
Organized by Brandon Hensley and Susan Clark

- Group dedicated to doing Galactic Science with CMB data: magnetic fields, dust, cosmic rays, turbulence, and more!
- Weekly telecons, currently alternating between:
  - Developing models of Galactic emission; PySM3
  - Journal club on Galactic astrophysics relevant to CMB data
- Member experiments: CMB-S4, ACT, BICEP/Keck, CCAT-prime, LiteBIRD, SO, SPT. More welcome, please get in touch!
- Interested? Please fill out our form:  
<https://forms.gle/meMgvadouxuJkLC4A>





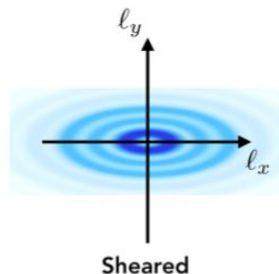
*New since the last meeting:*



tSZ & kSZ: galaxy formation and baryonic uncertainties in weak lensing

with Stefania Amodeo, Simone Ferraro, Nick Battaglia & ACT

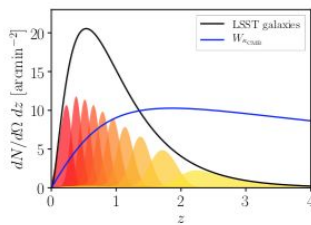
[arxiv2009.05557](https://arxiv.org/abs/2009.05557), [arxiv2009.05558](https://arxiv.org/abs/2009.05558)



Mitigating CMB lensing foregrounds

with Simone Ferraro, Nishant Mishra, Noah Sailer, Omar Darwish, Blake Sherwin, Marius Millea

[arxiv2007.04325](https://arxiv.org/abs/2007.04325), Sailer+, Darwish+, Schaan & Millea in prep



Joint analyses with galaxy lensing: shear & photo-z calibration

with Simone Ferraro, Uros Seljak

[arxiv2007.12795](https://arxiv.org/abs/2007.12795)

(Correlations with line intensity mapping

with Martin White [arxiv2103.01964](https://arxiv.org/abs/2103.01964), [arxiv2103.01971](https://arxiv.org/abs/2103.01971))



# Erin Healy

Graduate Student, Princeton University

Advisor: Suzanne Staggs

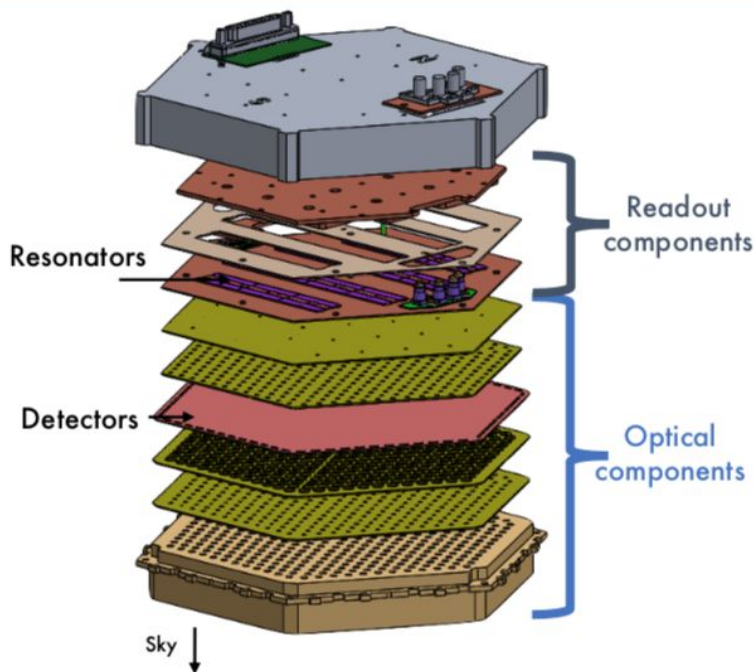


## Design, assembly, and validation of Simons Observatory's microwave-multiplexed detector modules

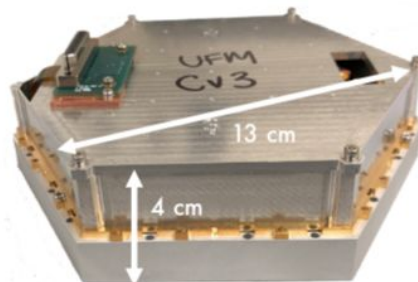
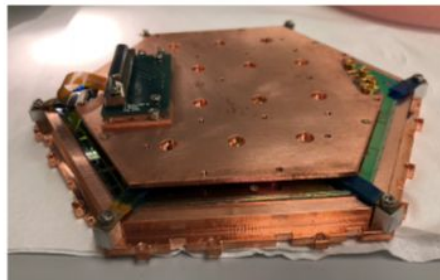
### Publications on readout modules

Healy, et al. "Assembly development for the Simons Observatory focal plane readout module," Dec. 2020  
<https://doi.org/10.1117/12.2561743>

McCarrick, et al. "The Simons Observatory microwave SQUID multiplexing detector module design," upcoming 2021



### Readout module



### Detector module

- Microwave multiplexing: TES detectors coupled to superconducting microwave resonators, each tuned to a unique frequency
- Each package has 1800 detectors and resonators read out with 4 coax cables
- Two readout chains per package: 900 unique frequencies per chain



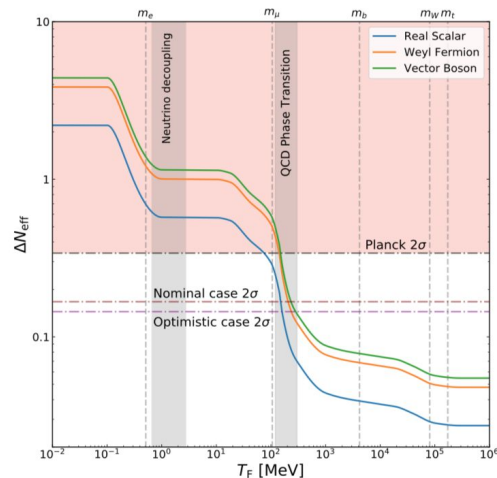
# Felipe Maldonado

Department of Physics, Florida State University



## Fisher Forecasts for SO, DESI, and Planck

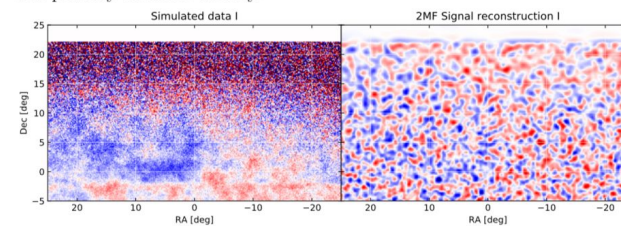
- Completely original from-scratch forecasting pipeline
- Baseline and goal SO sensitivity
- Cautious and optimistic  $\ell_{\text{min}}$  for GG, GK and KK
- No Limber approximation at  $\ell \leq 300$
- We find promising uncertainties while still being conservative
- $\sigma N_{\text{eff}} = 0.0836$  (most **Scale document up vice as tight as today!**)
- $\sigma N_{\text{eff}} = 0.07226$  (most optimistic)
- $\sigma \Sigma_\nu = 43.4$  meV (most conservative)
- $\sigma \Sigma_\nu = 40.3$  meV (most optimistic)
- Neutrino hierarchy determined only at  $\sim 1\sigma$  confidence



## 2-Messenger-Fields method on HEALPix and enmap

We implemented the 2-Messenger-Fields method for iterative Wiener filtering without a preconditioner (Huffenberger, 2018). The method can solve a new class of problems where the noise covariance is dense in all basis, but can be separated into parts sparse in real and harmonic space.

The implementation can filter polarized data with inhomogeneous, correlated noise in HEALPix and enmap pixellizations. We will make the implementation publicly available shortly.



## Outreach

I'm the Director of the CMB-S4 Saturday Science Series outreach program, which I lead with Juliet Crowell. I'm interested in dedicating myself to astronomy outreach permanently. Please reach out to me if you're interested in participating in the Saturday program or outreach in general.

## Contact Information

Email: fam14c@my.fsu.edu





# Gabriela Marques

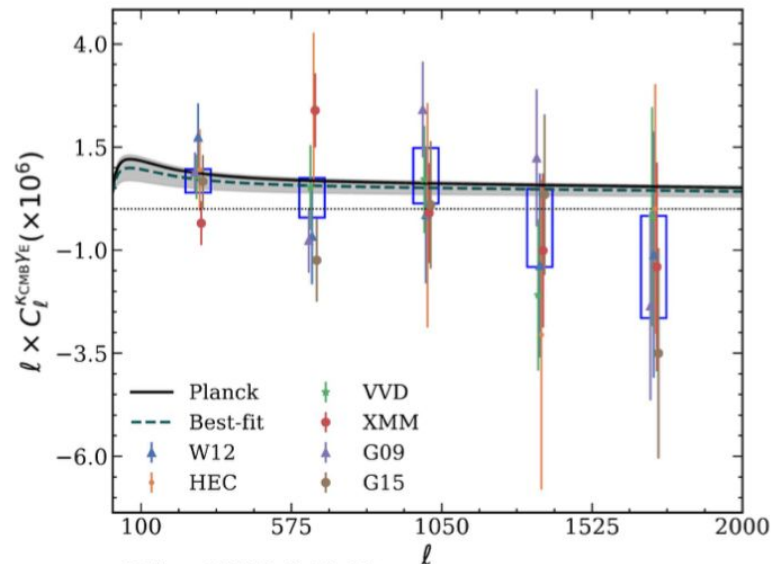
Postdoctoral Fellow at Florida State University,  
Kevin Huffenberger's group  
✉ gmarques@fsu.edu



- Research Interests:

- Weak Lensing Non-Gaussianity
- CMB lensing and other secondary anisotropies
- CMB x Large Scale Structure cross-correlations

Cross-correlation between Subaru Hyper Suprime-Cam Galaxy  
Weak Lensing and Planck CMB Lensing  
[**GAM**, Jia Liu, Kevin Huffenberger, and J. Colin Hill]



arXiv: 2008.04369





## What is the External Collaborations Committee?

- Mandated in bylaws
- Just created two weeks ago
- Raison d'être: provide the necessary link to external follow-up observations or survey data that are required to maximize the science return from CMB-S4.
- Near-term goal: facilitate science forecasting that requires external collaboration (e.g., with LSST), and that could impact CMB-S4 design.

We are looking to the Science Council to establish priorities for such forecasting projects, and to take the lead on planning any such forecasting exercises. We will then work with external collaborations to develop any necessary publication agreements and resource-sharing agreements.

We expect our membership to expand, to include people with strong links to simulation and forecasting activities in external collaborations.

### **ECC Parallel Session is 10:30 am to 11:15 am Pacific**

We will discuss potential forecasting projects and their prioritization and challenges to their execution -- in particular looking for challenges that can be solved with coordination with external collaborations. We expect attendance by Colin Hill and potentially other members of an SO body similar to the ECC, so we can learn from their experience and avoid duplication of effort.