

Flavour, Neutrinos & Cosmic Messengers

ECFA - ECR

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group

What is missing in the Physics Briefing Book?

The short, mid and long term goals of the field are highlighted nicely in general. Few points were raised:

- Tau magnetic moment
- Rare charm decays.
- Flavour physics with baryon systems
- LHCb searches for LFV decays of heavy, flavoured mesons
- Encourage model independent searches
- Add details to the nutau sector
- Solar neutrinos and coherent scattering
- Exotic BSM with neutrinos (e.g. Lorentz invariance violation, large extra dimensions)
- Accelerator input required for Cosmic Messengers (e.g. hadronic interactions).
- Real time observations between connected observatories
- Quantitative estimates on reconstruction of missing energy final states in strawman scenarios

How many things can be added without overloading?

Influence of Different Strawman Scenarios

- General Remarks:
 - Not all measurements can be done at large scale experiments as suggested by the strawman scenarios.
 - In small experiments, young researchers get to understand various aspects.
 - Large scale experiments allow massive R&D such that everyone benefits.
- Neutrino Landscape:
 - Next generation long baseline experiments in US and Japan, researchers get involved there
 - Next-to-next generation experiment in Europe? Requires engagement!
- LFV Landscape:
 - MEG II & Mu3e @ PSI, Mu2e @ FNAL, COMET @ J-Parc
 - Limited by muon beam rate and detector technology
- Future table-top experiments

Many researches to be done outside the strawman scenarios!

FCC-ee and FCC-hh

- FCC-ee is a clean ee environment.
 - Not as clean as colliders around the $Y(4S)$ threshold.
 - Studies about flavour tagging performance for Bs mesons needed.
 - Won't improve certain limits significantly after LHCb Upgrade II (e.g. $\sin(2\beta)$ and $\text{Br}(B \rightarrow \mu\mu)$)
 - Access to largely unexplored areas ($B_s \rightarrow \tau\tau$ or τ decays)
- FCC-hh only ideal if flavour physics can be done with extremely high pile-ups.
 - Innovation and research needed - is it feasible at all?
 - Benefits from Upgrade-II of LHCb, which is yet to be completely approved.
- FCC-ee technology almost mature while the one for FCC-hh is not.
- As no clear path: Compare to the option of smaller, more targeted experiments.

Start with FCC-ee and upgrade to FCC-hh

Collaborations

Between experimentalists and theorists

- Crucial for interpretation of results and planning of future experiments.
Example: Charm CP-violation
- In some Labs, they are next door and bump into each other every other day.
- In some experiments, theorists are part of the collaboration.

Between experiments

- Share resources (e.g. computing, software, analysis techniques, R&D)
- Happens a lot in small experiments as same people working on different experiments

Require platform or opportunities for exchanges.

Service Tasks

Situation:

- Needed in some experiments to be eligible as author.
- Maybe have to do things you don't really like.
- Experiment depends on it.

Benefits:

- Learn new things in a wider range of topics.
- Adds variety to the job

Opportunity to broaden your knowledge.

Open data

In some neutrino and cosmic ray experiments, final level data is made public

Final data

- Suitable idea for experiments in other context.
- Once analysis is finalised and the results published by the collaboration.

Raw data

- Do not publish
- Not understandable by people outside the collaboration.

How to publish which data?

Outreach

Provide informations to everyone - from taxpaying layman to experts.

- General Audience:
 - Provide videos
 - Public websites for some experiments available, some need content and style update
- Students:
 - Masterclasses - produce understandable material for broad audience of high school students
 - Activities at Universities to get students to join your experiment
- Experts:
 - Video recording of conference talk

Use state of the art technology (e.g. virtual reality) to boost the reach.

Train physicists in outreach and get support from experts.

Perspectives for Early Career Researcher

- Small vs. large experiments:
 - Number of papers as figure of merit disadvantages small experiments
 - Depends on funding agency and country
- Projects outside of Europe
 - Staying long term outside Europe is not considered as problem/disadvantage
 - Conflicts for people with family!
- Many proposed experiment within and outside Europe

Many opportunities in high and low energy physics.

Social Aspects and Human Factors

Not enough time to discuss all factors. Heavily weighted by ECR.

- Lack of women
 - Due to conflict of career and family?
 - Historical inheritance?
 - Other reasons?
- Diversity must not be the only reason to hire a certain person.
- Moving out of Academia
- Responsible Representative
 - At Collaboration, Facility or Institute level
 - Disputed: What about small collaborations?
 - Offer support and deal with issues of any kind

Dedicated representatives suggested