The GERDA collaboration -
talk given at GERDA inauguration, November 9, 2010, LNGS
Stefan Schoenert,
version of: Nov. 8

Dear....
…..director (Lucia Votano)
…..vice-president (Umberto Dosselli)
…..representatives of the institutions supporting GERDA
…..representatives of the funding agencies
…..representatives of the company which contributed to the GERDA construction
…..colleagues & friends

As spokesperson of GERDA, I have the pleasure to give you an introduction to the GERDA collaboration and the history of its formation.

In preparation for this talk, an important person pointed out to me that astrophysics often provides comforting allegories for our modest aspirations here on Earth - or rather: deep underground. Let me use some of these outstanding pictures from our astronomy colleagues to illustrate our story.

[show picture of star forming region]

[The fruitful environment]
The **environment** which is needed to start a new experimental project and to form a new collaboration must be very special. You can compare this with star forming regions in our Universe where a lot of different things are happening simultaneously: you can see giant clouds of gas and their collapse, proto-star formation, accretion discs, and SN explosions.

Let me use this picture and explain to you the special environment and ingredients which we had when embarking on this endeavor:

About a decade ago, the **physics environment** in our field changed dramatically: Solar neutrino experiments, including the Gallex/GNO

experiment here at Gran Sasso, showed that neutrinos are particles which have non-zero rest mass. This discovery caused the particle properties of the neutrino to become a central topic in modern elementary particle physics and cosmology. Maybe the hottest topic today in this field is the question whether neutrinos are their own anti-particles – The GERDA experiment addresses this question. (Carla Cattadori will outline the physics case in the following talk). Stimulated by these results there were now predictions for the maximum life time for neutrino-less double beta decay – not that they are necessarily reachable experimentally for all allowed parameters, but at least they give experimental projects clear benchmarks to test.

Science is made by people. Therefore the '**people environment'** is as crucial as the underlying physics case. Some of us – the INFN teams around Carla Cattadori, Enrico Bellotti and Sandro Bettini, the INR group around Leonid Bezrukov, and us from MPIK - were working together in the LENS project. We decided early 2002/3, given the latest results from solar neutrino oscillation measurements, not to continue with LENS, but to think about new projects. One of which was the search for neutrino-less double beta decay of Ge-76. Our Gerda collaborators, who come from high-energy physics and who were working at DESY, were as well stimulated at the same time to define their future research program. Having both high- and low-energy physics groups present in the two MPI's in HD and Munich was surely a central ingredient to form the 'seed' - and Werner Hofmann surely a key player in this process. With Allen Caldwell from MPI and Josef Jochum and Peter Grabmayr from Tuebingen with their respective teams, the 'seed group' had gained substantially in expertise and criticality.

Another important ingredient in this 'star-forming region' was to have an **original idea** to improve substantially the experimental sensitivity: Gerd Heusser proposed already in 1995 to operate bare germanium detectors in liquid nitrogen.

I want to remind you that conceptual projects based on this idea were promoted already before GERDA: Klapdor-Kleingrothaus proposed the GENIUS concept and later Yuri Zdesenko the GEM concept.

Two other ingredients should als be mentioned here:
Klapdor-Kleingrothaus and his group from the Heidelberg-Moscow collaboration **claimed evidence for observation** of neutrino-less double beta decay of Ge-76.
This claim however is controvesial. Though it is important for a new experiment to have a clear cut goal to test, this was not the driving argument - at least not for me - to push the GERDA project. As you will see from Carla Cattadori's and Karl Tasso Knoepfle's talks, we designed the experiment rather as a 'pathfinder' for the ultimate Ge-76 double beta decay experiment in order to explore the mass range predicted by the inverse mass hierarchy.

With the appointment of Peter Gruss as the new president of the Max Planck Society in 2002, and given the financial situation in Germany during that period, a consolidation program was initiated within the MPG. The rebound in MPG fortunes allowed the MPIK and the MPP groups to successfully apply for significant funds in 2004.
.
[The seeds and the formation of the proto-star]
[slide with star formation & proto star]
Though we were in a very dynamic **accretion phase in 2003** - with the MPG/Tuebingen/INFN and INR groups at it's center – it was not at all clear whether the already 'glimming proto-star' GERDA will make it into the burning phase of the 'main sequence'. Often enough these proto-starts either do not ignite hydrogen burning– or even worse – burn out much too fast.....

With stars it is mainly about the mass. Collaborations need besides that also other important ingredients: maybe most important is that there is the desire to work closely together, and to trust in each other's competence and integrity and respect each other's work. This is the basis for a successful collaboration - and the foundation for the leadership to be able to guide the project successfully.

The mentioned 'seed group' realized soon that other Russian teams needed to join the endeavor in order to pool together the critical mass of **people expertise** and Ge-76 isotopes. Therefore, it was very important to establish confidence between the young GERDA seed group and the leadership from

Kurchatov Institute - Spartak Belyaev and Valentin Lebedev - who, in the past, were the Russian partners in the Heidelberg-Moscow collaboratio. Not less important was to attract the Russian teams from the former IGEX experiment, which in the past was competing with HdM. From ITEP this was Igor Kirpichnikov and from INR Anatoly Smolnikov and colleagues. From JINR Dubna an other team of double beta decay experts around Victor Brudanin - working also in the NEMO experiment – joined the project.

This part of the collaboration forming was in particular a very interesting job, given the pre-history of this 'hot and dynamic' environment. Various visits in Moscow, counter visits and supportive interventions of the INR team helped the Russian 'accretion' continue successfully.

Another intricate problem to resolve were custom and tax issues for the IGEX crystals which at that time were in Spain, but previously in the USA. The Russian INR/ITEP team worked hand in hand with Frank Avignone from US and resolved all problems.... and the Russian groups were able to provide a fundamental contribution for GERDA: a strong group of expert physicists and 18 kg of germanium detectors enriched in the isotope Ge-76.

Without this valuable contribution, the Phase I of GERDA, and possibly GERDA as a project, would not have been possible!

Meanwhile – again with great care and vision - our Russian colleagues were negotiating with the Russian Ministry of Atomic Energy (nowadays called State Corporation ROSATOM) to receive a **firm quote for the production of new Germanium** material enriched in Ge-76 for Gerda phase II. (Vasily Kornoukov from ITEP will tell you all about germanium enrichment at the end of this session.) … and they were doing this at a time when we did not know whether there would be any funding at all!

Another helpful force for stabilization of the 'young proto-star' was our (friendly) competitors from USA: the **Majorana collaboration** is preparing a similar experiment to GERDA in the USA.

We convinced each other that it is to each other's benefit to explore different

experimental routes first - and only merge forces at a later time. We agreed in a LoI to work together with an open exchange of information - and when the time is mature, to pick the best experimental approach tested in the two experiments and challenge the 10 meV neutrino mass scale together. Since then we have common projects and participate regularly at each other's collaboration meetings.

[Completion of the accretion and transition to the 'main sequence']
[HR plot]
The (star) formation was completed successfully with the first GERDA collaboration meeting in February 2004 at MPIK in Heidelberg. The 'ignition' of GERDA was then triggered by the approvals of the proposals to the MPG, to the INFN and and to the BMBF. But the real start was given only in February 2005 by Eugenio Coccia, at that time director of the LNGS, when he approved the experiment
[photo Coccia during CB meeting].

Since then we are 'burning on the main sequence'.
[HR plot with overlay of all institutional logos].
The GERDA collaboration was further strengthened by
Marcin Woicik from Jagelonsky Univ. Cracow, and
Mikael Hult from IRMM Geel joining, and
with Manfred Lindner's appointment as director at MPIK,
Laura Baudis from University Zurich,
and Kai Zuber from TU Dresden.

More recently, Xiang Liu moved from MPI Munich to Shanghai to start a local GERDA group there and very recently also TU Munich.

Different to the allegory, where the burning on the main sequence is usually very stable, a collaboration can develop turbulences at any time. All experimental physicists now very well that getting an experiment running successfully is at least as challenging as to initiate it. The required originality and creativity to master those challenges can not be appreciated high enough!

(Karl Tasso Knoepfle will share some of them with you in his presentation later on).

As in the initial phase, it requires the dedication of the people to the project, the respect for each other's work - and the confidence from the scientific community. First of all I want to mention the roles of the LNGS director, the LNGS SC committee members, the representatives of the funding committees, and very important, the colleagues from the field and from competing experiments.

Today's celebration - where we inaugurate the completion of the GERDA construction - shall also serve for that purpose.

[**Future – SN explosion]**
Let me close with my view for the future: After resolving the initial challenges of the current start-up phase and after some time of continuous data taking (and similar long lasting discussions on how to carry out in the best way a blind analysis), I have no doubts that GERDA will provide unique results. Whether this is a discovery signal of neutrino-less double beta decay or not: it will explore unknown (physics parameter) territory and generate new knowledge, it will trigger new ideas and applications, educate students and stimulate future experimental and theoretical work to understand the fundamental rules of the game of our (physical) world. - Just like a Super Nova explosion feeding back into the star forming region out of which eventually live emerges
[SN]
[GERDA collaboration photo].

End