Elec's marriage
(The nuclear fusion)

"Can you hear it?" asked Elec.

"What?" asked Lectron in a lazy voice. He was sunbathing, spreading out and catching the stray photons, which were so unfortunate as to get into his way.

"The song."

Lectron was all ears. "Yes. Nice," he said and reached out for another photon.

"More than nice. Sweet."

"Ah," snorted Lectron.

"I am going to find out, what's that."

"All right." Lectron turned to his other side and Elec waved away. It was a choir what enticed him with a sweet, sorrowful song. Two high and a low pitch.

"You must be a proton," he addressed the choir from a distance.

"Proton? No. I am a hydrogen ion."

"Oh." Elec was puzzled. "You look like a proton. What's the difference between a proton and a hydrogen ion?"

"Not too much, in fact. Unlike protons in an atom, I have the potential to become hydrogen. With a handsome electron," she added.

"I see. Why is your beautiful song so sad?"

"Because I am lonely. I want a family, I want to be in an atom, at least in a plain hydrogen atom. I am looking for my soul mate," she said, and started to sing again.

Elec was enchanted. He listened to the music. The three voices merged in an ethereal harmony. He felt he could listen to it to the end of time.

"I love your song," he admitted.

"Oh, really?" cheered up the threesome voice. "I think, we would get on well." Then after a short break, she asked Elec coaxingly, "Would you marry me? We would make up a nice hydrogen atom."

The question took Elec by surprise. "In fact... I have never thought about it so far..." Then he trembled with happiness. "Oh, yes, it would be wonderful. Just buzzing around you and you would sing me enhanting songs."

"Then what would you bring into the marriage?" asked the bride in a matter-of-fact voice.

"Let me see. I have a negative charge and some mass."

"Oh, your mass is negligible compared to mine. My mass is 1836 times higher than yours," said the proton depreciatingly. "Not to mention your size."

"My size? What's wrong with my size? OK, it is small, if I stand still, but I am never still. I will embrace and protect you at a decent distance. You give the mass and I give the volume to the hydrogen atom."

"It sounds feasible," nodded the proton.

Elec fluttered about and went to get Lectron as the best man. Lectron wasn't happy with the idea, but he saw his friend was head over heels in love.

"I want a very special wedding," said the proton. "I want the ceremony in the sun."

"Where?" the electrons were taken aback. "In the sun? It is a long way. It takes eight minute even for massless photons. We have mass, we would travel slower. It would take ages."

"I have friends in the sun, my bridesmaid-to-be lives there, and anyway, I want to spent my honeymoon in warm regions."

The electrons finally gave in and they made their tiring journey towards the sun, against the torrent of photons. Even the envelope of the sun was hot, six thousands degree, but still wasn't enough for the proton.

"Let's go further in." As they made their way in, it got crowded with particles, mainly hydrogen, later bigger deuterium and even bigger helium atoms. Horde of tiny neutrinos zigzagged amongst them. Everybody was very energetic due to the high temperature. Inside it was over a million degree. Now the proton was satisfied. She found her friend, another proton, who was happy to be a bridesmaid. As they repelled each other, the bridesmaid decayed into a neutron, a neutrino and a positron. The neutrino away flew in a wink, but the positron looked helpless for a while. The electrons got upset.

"Hey, it wasn't nice of you, to release a positron. What if she eliminates the bridegroom?"

"Oh, don't be so fussy, darling," said the bride, "You are swift enough to dodge her."

The bride and her bridesmaid clung to each other, while the two electrons followed them at a decent distance. The ceremony took place in this hot atmosphere. The onlooking particles cheered and scattered the newly married pair with photons.

"Now you can take your orbital around me," said the wife. Elec happily took an orbital, releasing some photons to lessen his energy. To his surprise, the neutron stayed in the nucleus.

"Darling, when will your friend leave us? You wanted a hydrogen atom, but with your friend we are deuterium, not hydrogen," he turned to his wife.

"Oh, sweetheart, are you already jealous?"

"Yes I had a different idea about our marriage. Just you and I, singing and flitting."

"Don't worry, protons and neutrons are only friends, we are not attracted to each other electrically."

"Then why is it still with us?"

"Because I have an ambitious plan. Why do you think I wanted to move into the sun?"

"Moving?" poor Elec was startled. "I thought we have come here only for the honeymoon. Anyway, this place is too busy and noisy to live in. I can hardly hear you. You even don't sing anymore."

"Why would I sing? I have got you. And there are far more important things."

"For example?"

"For example building bigger atoms. You can't build atoms on the Earth, even a single deuterium, like us. We need a high energy level, high temperature to squeeze protons together, to overcome the repelling force between us. I want to build a helium atom. Helium is a noble gas with two protons, two neutrons and two electrons. What a perfect symmetry! I want to be noble."

Elec sighed. "I don't like your ambitious plan. Let's go back to the Earth, to live happily ever after."

"Oh, darling, don't be so negative. Neutron, what do you think?"

"I am neutral in this question," said the neutron.

"You are neutral, in general," shrugged the proton, then turned to Elec. "We already took the first step, we are a deuterium, twice as heavy as an ordinary hydrogen, but we are still a hydrogen isotope. Please, darling, let's try the second step. After I would sing again with joy."

"What is the second step?"

"To get another proton."

"All right, let's hover around to find one."

They found a stray proton soon, who was happy to join the company. Emitting a photon, she embraced the proton and the neutron in the nucleus.

“Oh, now we are a helium-3 atom,” rejoiced the proton. “It is helium, but not perfect, not helium-4. Darling, we badly need another electron now, as there are two positive protons here, in the nucleus with one neutron. You are not strong enough to counteract our positive charges.”

Elec gave in again, “All right. I have to ask Lectron about it.”

Lectron, who was lingering around, hoping that Elec would be bored with his marriage soon, didn’t entertain the idea.

“Before I join in your helium-3, I want to know the next step,” he said to the proton.

“Then we need one more neutron and the perfect helium is done,” said Elec.

“Oh, it is not so simple, unfortunately. You can’t find a free neutron in the sun. They are so unstable, they decay into proton within minutes or hours. That’s why my proton bridesmaid turned into neutron beside me. They are stabile only within an atom. So we have to find another helium-3 atom.”

“And?”

“And to fuse into a perfect, helium-4 atom.”

“Hang on. I am not so good at math,” said Lectron, “but two helium-3 atoms have four protons, four electrons and two neutrons altogether. What will happen with the excess two protons and electrons?”

“Oh, the protons can leave at will, we don’t need them. They can start another helium atom.”

“I see. What about the surplus electrons?”

“Well, it is a different story. Two positrons also will be created during the collision. They will meet the electrons and annihilate each other.”

At that word Elec took a great leap and stepped out.

“Where are you going, darling?” asked the proton.

Elec shouted back, “To file for a divorce, darling. I am too young to be annihilated for you. Good-bye and I wish you the biggest atom in the world.”

Two forces in atoms

Atoms are forged in stars exclusively. Though there are free, positive charged protons everywhere, the repulsive electric force makes impossible their union. The closer they get to each other, the stronger the repelling force is. However there is another force acting on them, which comes into play when they are close enough to each other. This attracting, so-called strong force can overcome the repulsion and keep the protons and neutrons together in a small place in the nucleus. It takes place when the particles have enough energy to jump over the electric force barrier.

Temperature and energy

The sun (and all the stars) are hot places. While the outer temperature is ‘only’ six thousand degrees, inside the furnace can reach the fifteen million degrees. Temperature means energy. The more fierce the particles dance, the higher the temperature is. Fierce frisk enables to jump the barrier of the electric repulsive force and to create new atoms. This process is called nuclear fusion.

During the fusion photons come into being as by-product. Thanks to them we can enjoy the sunshine.