

# THOR

infrared slavery

Gabrielli

Tomasello



THOR



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## *THOR - Infrared Slavery*

by Simone Gabrielli and Margherita Tomasello

Matter under extreme conditions in terms of temperature and density, as in the early Universe or in compact stellar objects (e.g. neutron stars) can be created and studied with the help of relativistic heavy ion collisions. The European COST Action “Theory of hot matter and relativistic heavy-ion collisions” (THOR) establishes a theoretical community platform as counterpart to the ongoing vigorous experimental activities.

Here we want to play a little more with the name THOR, and we invite you to enjoy the graphic novel prepared at THOR’s request by Simone Gabrielli of the Scuola Romana dei Fumetti, with the assistance of Margherita Tomasello. Throughout the story you can find some of the elements of the physics of ultrarelativistic heavy ion collisions that we study in our network.

The graphic novel and a brief scientific introduction are also available at the URL:  
<https://thor-cost.eu/outreach/thor-meets-the-physics-world>.

We hope you enjoy it!

Maria Paola Lombardo, Marcus Bleicher, Boris Tomasik  
THOR-COST Science Communication Officer, Chair and vice-Chair

### Credits

The project was initiated by Maria Paola Lombardo, the English translation has been prepared by MPL, Raffaello Conti and Simon Hands. We thank our colleagues in the THOR-COST network, in particular Chris Allton, Jan Čepila, Axel Maas and Hannah Elfner; Giorgio Chiarelli and Catia Peduto from the INFN Communication Office, and Raffaello Conti for their feedback and helpful discussions.





The spaceship Proton 1975 was travelling at full speed through the chill of interstellar space, negotiating a course through a stream of rock fragments trying to avoid at least the larger ones. As for the small ones, well, they just scraped and rebounded from the vessel's hull, as had happened many times previously on its continual quest in search of signs of other friendly spacecraft.

For as long as he could remember, Ka-Bibbok had hated those rocks. In fact, he suffered from dreadful space sickness that just got worse in such situations. He was nonetheless doing his best to act unconcerned, as he felt such weakness was not becoming to an experienced pilot. However, Ka-Bibbok's space-sickness was as clear as if supernova-lit to the other co-pilot, Quark-Up Par-Isik, and to the navigator, Quark-Down Sifk. It was a constant source of jokes and innuendo between the pair whenever Ka, green with nausea, needed his duties covered by Sifk








..FREE! WE USED TO BE FREE! THE KINGDOM OF PLASMA  
WAS THE BEST OF ALL POSSIBLE WORLDS,  
FILLED WITH PEACE AND HARMONY...  
WE SHOULD HAVE KNOWN IT WAS TOO GOOD TO LAST...



...AND FORCED TO FLEE  
IN THE *PROTON, NEUTRON,*  
AND *MESON SHIPS!* NOW WE ARE  
CONFINED, IT'S A SORT OF SLAVERY  
...BLA BLA BLA...



KA, WE ALREADY HEARD THIS A  
ZILLION TIMES!!  
BUT SIFK JUST CAN'T REMEMBER,  
HOW MANY TIMES DOES  
SHE HAVE TO TELL YOU??



WELL WE HAVE BEEN HERE FOR AEONS,  
I WAS JUST CHATTING TO PASS THE TIME.

OH DO PLEASE SHUT UP  
THE PAIR OF YOU!



"Please don't get me wrong Ka! True, I don't remember any of the details of your story, but I still enjoy hearing it!... so thanks very much for your kind concern, but I am not in the least bothered by your tales (even if I have to listen to them over and over again...)..it's just this damn helmet..it's too tight! I hate it!"

Sifk struggled hard to take off her Gluehelmet... but to no avail... just like every other time, any attempt to get rid of this headpiece and its connecting tube full of some gluey material seemed doomed to fail.

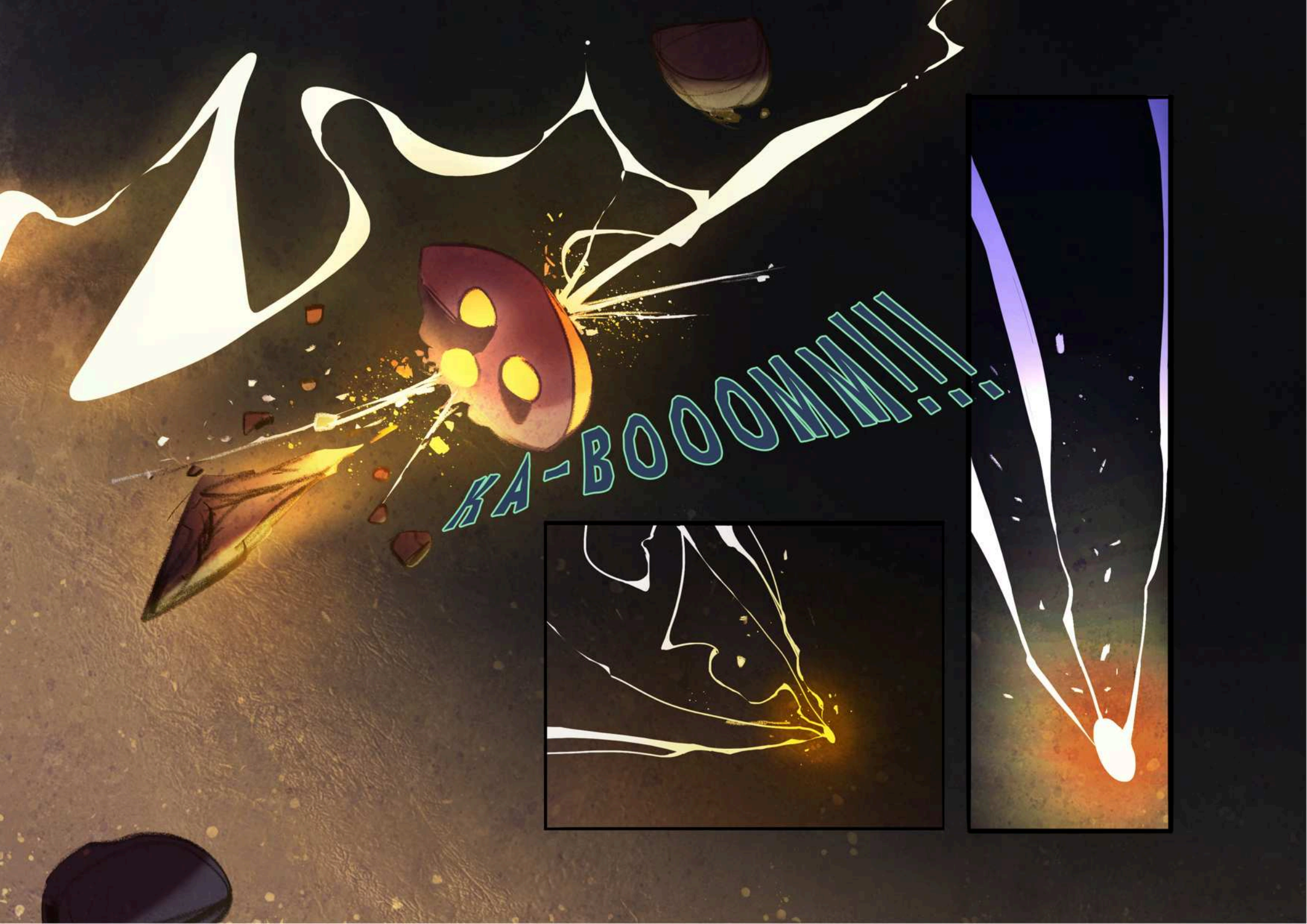
Still, at least the helmet offered one advantage: it enabled telepathic communication... but, frankly, they all preferred to talk with each other the old-fashioned way!

After two days of constant zig-zag through the intergalactic debris they finally steered clear of the mayhem and reached a region of relative quiet. The three cosmonauts, especially Ka, breathed a sigh of relief

"At last some calm! I don't mind admitting I was a teeny bit queasy from all that bobbing and weaving! but... look out!... that looks like..."







KA-BOOOOM!!!







The impact with the planet was terrible! The spacecraft penetrated the outer crust like a bullet going through tree bark: the rocky surface exploded, scattering debris over hundreds and hundreds of metres...The three pilots immediately lost consciousness.

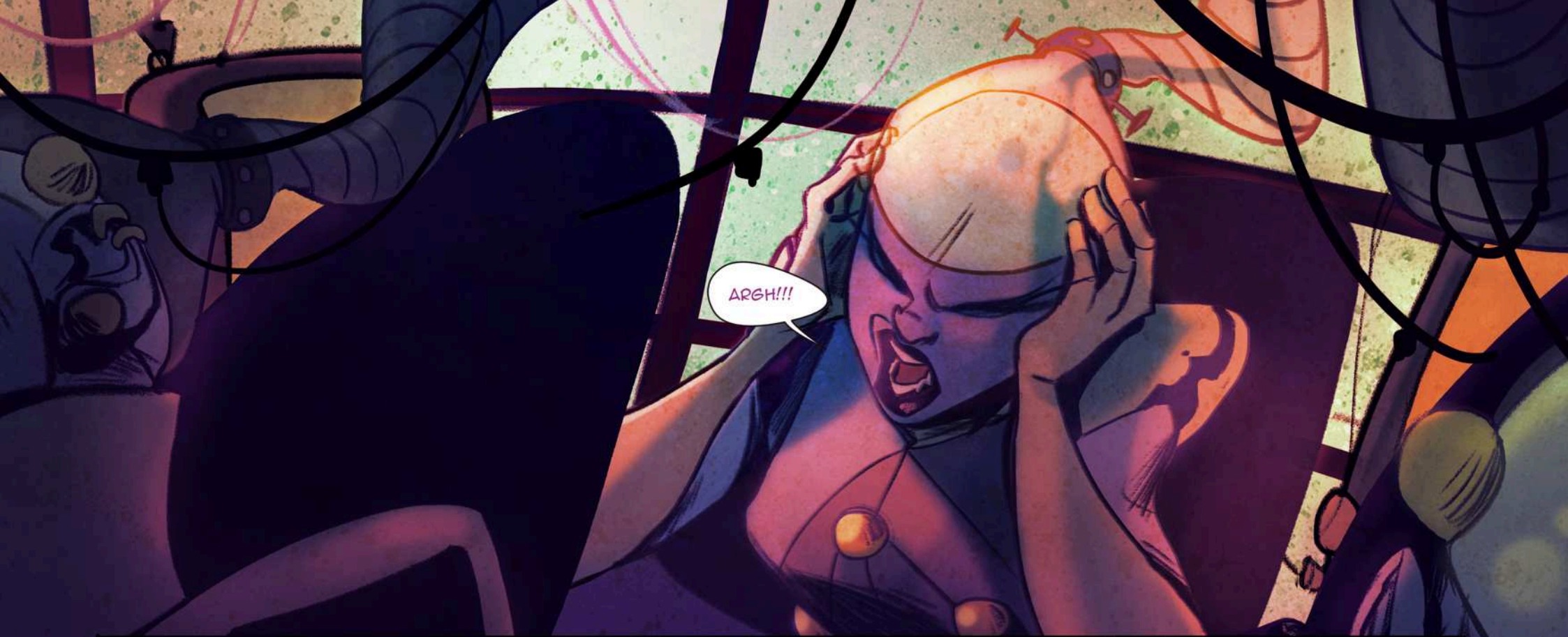
Hours, and then one day, maybe two, passed with no sign of life... At last, Sifk's face twitched slightly, her brow creased with the pain, eyes tight shut, teeth clenched. Strange, puzzling images begun to surface in her mind.. again she struggled to rid herself of the helmet, but still it wouldn't budge, as if welded to her head.



















KA! PAR! WAKE UP!  
NOW I REMEMBER!

WHAT THE...



OH DEAR...YOU'RE REALLY MESSED UP,  
GIRL... NO SURPRISE..  
THAT WAS QUITE A BLOW..

MY MEMORY CAME BACK TO ME!  
I AM NOT SIFK! I AM SIF,  
WIFE OF THE GOD THOR!



MY FRIENDS, TRUST ME! AND FOLLOW ME!  
WE ARE GOING TO A SPECIAL PLACE..



...AT THE SPEED OF THOUGHT!!!



AAAAAAAAHHHHHHHH!!!!

AAAAAAAAHHHHHHHH!!!!



It was like being swirled around in a giant centrifuge. Ka-Bibbok and Par-Isik felt their eyes almost pulled from their sockets, a terrible, intense, but thankfully brief sensation.

After journeying at such incredible speed, the spacecraft slowed down, then came to an abrupt halt, and the two Quark-Ups felt sick again. But Sifk was feeling completely normal, relaxed even.

And then they saw it: a marvellous, unimaginably beautiful landscape, in which every object screamed wealth and prosperity. A crown of imposing rocky mountains protected this fairy-tale kingdom from the threats of the surrounding universe: Asgard shone like a living crystal emerging from the heart of the planet. Totally unfazed, the

Quark-Down continued her story

"...this is the kingdom of Asgard. The kingdom belongs to Thor, my husband the god of Thunder, and to me. Follow me, we will go to our dwelling at Bifskirnir Castle: once there you will no longer doubt my words."

"Sifk, what the... I... I really don't understand..."







...I BROUGHT YOU HERE BECAUSE MJOLLNIR,  
THOR'S MIGHTY HAMMER, HOLDS THE KEY TO EVERYTHING!  
IT CAN DELIVER AN ENORMOUS ENERGY, INSTANTLY,  
THROUGHOUT THE UNIVERSE...



WE CAN SET FREE ALL QUARKS FROM  
WHICHEVER VESSEL CONFINES THEM...  
RESTORE THE KINGDOM OF PLASMA...  
AND WE WILL BE A FREE PEOPLE AGAIN!



WELL... ASSUMING THIS ISN'T ALL A DREAM...  
HOW D'YOU SUPPOSE WE'LL  
MANAGE TO STEAL A GOD'S HAMMER?

I AM SIF, GODDESS OF WAR! ALL WEAPONS  
ANSWER TO MY COMMAND! WE ARE SO INFINITESIMALLY  
SMALL THOR WON'T MANAGE TO DETECT US...  
TRUST ME, I CAN HANDLE THIS!





EH! WHAT'S THIS?...



STOP! WHERE DO YOU THINK YOU'RE GOING?!?





I TOLD YOU TO COME HERE!  
OF ALL THE NERVE!!!



ENOUGH NOW!!  
HERE, I SAID!





THAT'S MORE LIKE IT! MJÖLLNIR...  
BUT WHAT'S HAPPENED TO YOU?  
I HADN'T SEEN ANYTHING LIKE THAT  
IN MILLIONS OF CENTURIES!  
...MMMM



ONLY SIF HAD THE POWER  
TO DO THAT...

...SIF?? IS THAT YOU?  
AM I GOING MAD?





S-SIF!...  
I DON'T BELIEVE IT!..



Thor couldn't believe his eyes... he knew full well that besides himself, only Sif, the Goddess of War, would have been able to handle Mjöllnir. He stared at the floating hammer, trying to convince himself that the trusted companion of so many battles could hear his words...

"S-Sif...is it really you? If it is you, please, follow me to the Altar of Souls, it will help us speak anew"





A character with a beard and a blue robe stands in a dark, futuristic room. The room features tall, dark pillars with glowing pinkish-purple lights. In the foreground, a large, ornate, golden altar sits on a cracked floor. The character is looking towards the altar. The lighting is dramatic, with a bright light source at the top of the frame.

...COME, APPROACH THE ALTAR...THINK HARD  
AND CONCENTRATE, TRY TO CONNECT WITH HIM...  
SOMETHING'S GOT TO HAPPEN..





IT IS YOU...  
BY ODIN'S BEARD!



..IT'S ME,  
MY LOVE..



The lovers moved closer, each struggling to master the mistiness filling their eyes. Thor, as if woken from a millennium's deathly slumber, felt his heart thunder. Sif's emotions erupted in gushing tears.

"But where have you been, my beloved? I have been looking for you everywhere, century after century, till I lost hope..."

"Oh Thor!...I couldn't have imagined..I lost my memory... long long ago... Here, listen to my story"

The goddess regained her composure, wiping away the tears still streaming across her lovely face. After a deep sigh, she began:

"The kingdom of Plasma was lost, with the attack on our own front probably the most violent. Our soldiers couldn't offer any further resistance, there was fire everywhere, a burning cloud swept mercilessly over our helpless army. Desperate Quarks were fleeing in all directions... but there was something strange, Thor, something didn't quite fit the picture..."





"...it was like fighting an invisible enemy, the Quarks' resolve was exhausted and flight was our only hope. We built several ships, to escape in small groups of two or three without being detected...the effort was beyond imagination, I was numb with fatigue..and then, Loki took advantage: he transformed me into a Quark, confined me within one of the small shuttles, Proton-1975... and at that point I lost my memory, and vanished without trace..."








WHEN MY MEMORY RETURNED,  
I CAME BACK AT ONCE... OH, THOR,  
YOU ARE THE ONLY ONE WHO  
CAN LIBERATE THE QUARKS...

...WHO CAN DEFEAT THIS DREADFUL  
CONFINEMENT KEEPING US LOCKED  
INSIDE THOSE TINY VESSELS...

...THE QUARKS BY THEMSELVES JUST  
DON'T HAVE THE ENERGY...PLEASE  
USE MJOLLNIR, AND SET US FREE AGAIN!



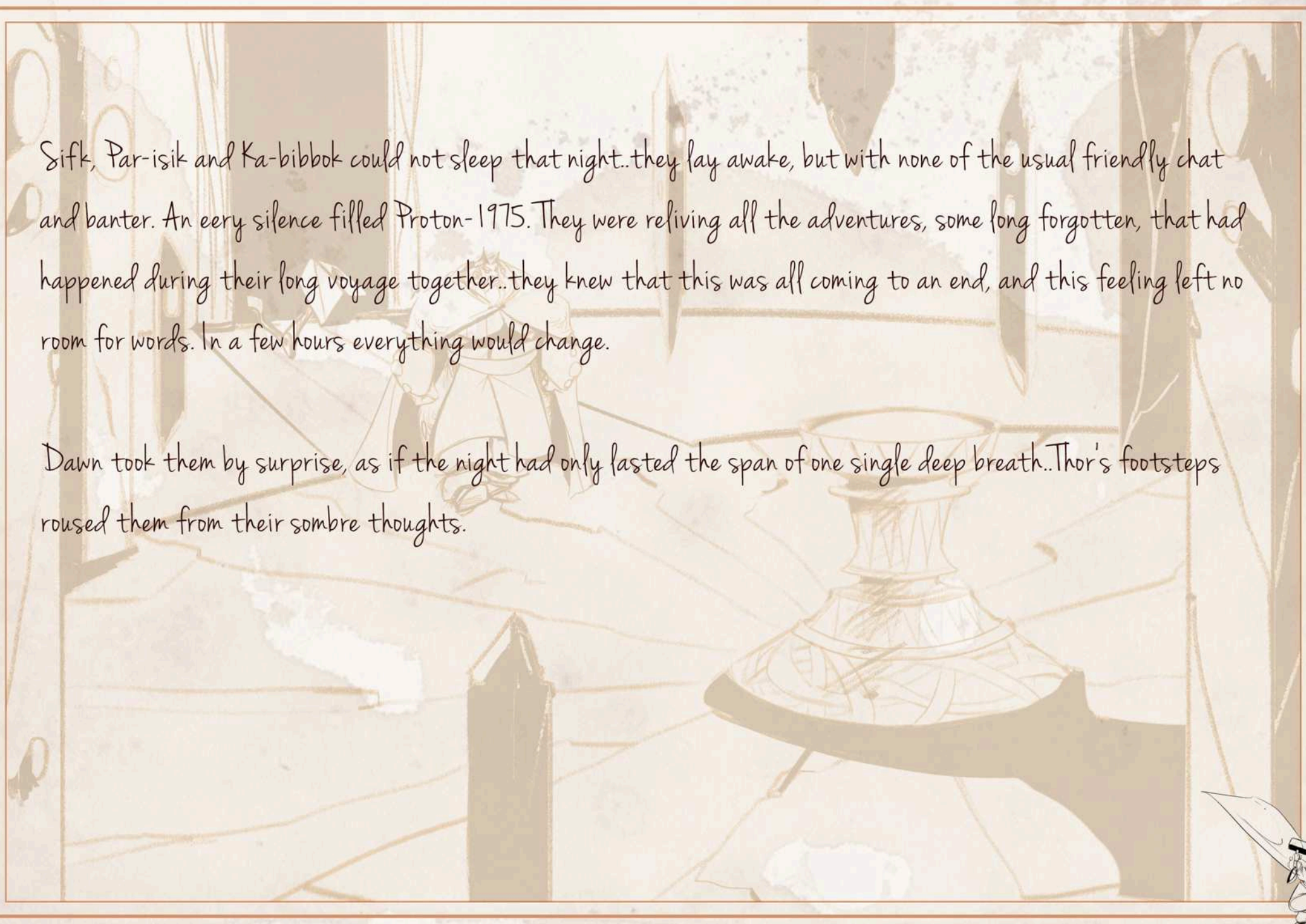
YOU ARE ASKING ME TO SET FREE ALL  
THE QUARKS IN THE UNIVERSE? TO RETURN  
TO THE KINGDOM OF PLASMA?  
BUT YOU KNOW, THEY MAY STILL STAY  
STRONGLY BOUND TO ONE ANOTHER...

..AND ANYWAY THE ENERGY I SHOULD NEED TO  
RELEASE THEM WOULD MAKE THE TEMPERATURE  
UNIMAGINABLY HIGH... I...

I REALLY DON'T KNOW SIF...THERE  
ARE MANY ASPECTS TO CONSIDER...  
I HAVE TO THINK...


...I WILL GIVE YOU MY  
ANSWER BEFORE DAWN!





Sift, Par-isik and Ka-bibbok could not sleep that night..they lay awake, but with none of the usual friendly chat and banter. An eery silence filled Proton-1975. They were reliving all the adventures, some long forgotten, that had happened during their long voyage together..they knew that this was all coming to an end, and this feeling left no room for words. In a few hours everything would change.

Dawn took them by surprise, as if the night had only lasted the span of one single deep breath..Thor's footsteps roused them from their sombre thoughts.







I AM HERE, SIF...  
IT WAS A LONG NIGHT.  
BUT NOW I HAVE AN ANSWER.



YES, I WILL HELP YOU, QUARKS.  
I WILL SET YOU ALL FREE... BUT  
FIRST I WANT YOU TO UNDERSTAND  
EXACTLY WHAT THIS MEANS...



...I NEED TO SHARE THE BURDEN  
OF THIS DECISION WITH YOU!...





...LOOK, LOOK THROUGH MY EYES,  
AND YOU WILL SEE ALL CORNERS OF THE *UNIVERSE!!!*



The walls surrounding the Altar of Souls came to life..as if each wall were a window opening onto a distant corner of the Universe.

Accompanied by a myriad dazzling flashes, shining visions of an infinitude of stars emerged from Mjöllnir: multitudes of worlds, innumerable faces...There were faces of everyone, from all kingdoms, of all species, of any color, any substance..Those faces were startled as horrorstruck they witnessed the dissolution of their world. Thor was roaring, the torrent of his powerful will creating and shaping a myriad of dazzling sparks. Within this incredible light the hammer was shining like a star.

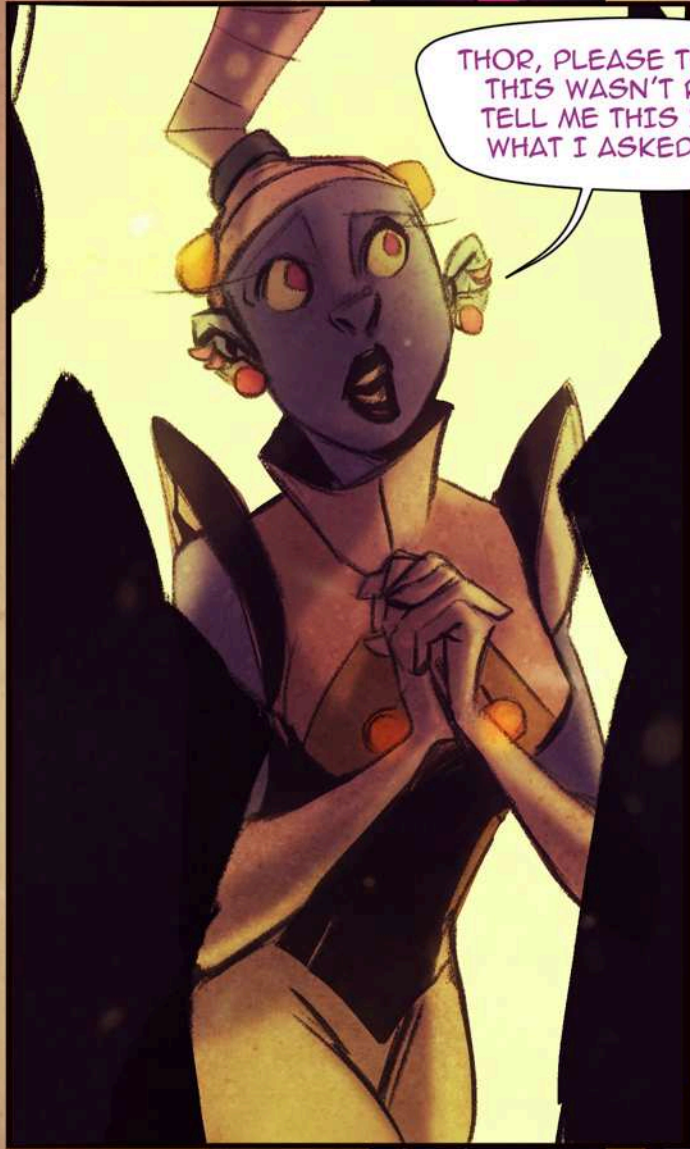
Odin's son's face was twisted in a grimace from his awesome effort, the pain near unbearable even for a god. Thor was contemplating the end of the Universe, the Universe as it had existed for billions of years..











THOR, PLEASE TELL ME  
THIS WASN'T REAL!  
TELL ME THIS ISN'T  
WHAT I ASKED FOR!



SIF, MY LOVE, I AM SO  
HAPPY THAT NOW  
YOU UNDERSTAND...



..AND YOU, ACCURSED FELON,  
COME HERE!




Loki is shown from the waist up, wearing a blue and red coat with a gold circular emblem on the chest. He has a thin mustache and is looking towards the right.

GREETINGS SIF,  
LONG TIME NO SEE..  
WHAT BRINGS YOU HERE?

Sif is shown from the waist up, wearing a purple and gold outfit with a helmet-like headpiece. She has a determined and angry expression, pointing her right hand towards the left.

LOKI?!? YOU?!? HOW DARE  
YOU, YOU EVIL SON OF A...

Loki is shown from the chest up, wearing a blue and gold outfit with a hood. He has a mustache and a serious expression, looking towards the right.

COOL IT, SIF...HE'LL GET  
WHAT'S DUE FOR HIS  
MISDEEDS, BUT TODAY HE  
GAVE ME THE SOLUTION...














GUYS, THAT'S ALL I COULD DO FOR YOU... A MORE SPACIOUS VESSEL, THE MESON-1975... AND I BID YOU BON VOYAGE!

BUT PLEASE, MY FRIENDS, COME BACK TO SEE US AGAIN!



WE WILL *SIF*! THIS IS THE ONLY WAY...

AND YOU KNOW JUST HOW CURIOUS WE ARE! WE LOVE TRAVELLING, AND THIS IS EXACTLY WHAT WE WOULD HAVE WISHED!



THEN LET ME SUGGEST A VERY SPECIAL AND INVITING DESTINATION...



...PLANET EARTH!!!



In the blink of an eye Meson-1975 disappeared into the chill of interstellar space. Par-Isik and Ka-Bibbok, seated at the controls, looked at one other.

"...I will miss Sifk...but I'm so happy for her..."

"...Yeah, me too...although I wouldn't have minded the chance to quit the ship myself..."

"What? you mean you've had enough of our voyages, of our discoveries?"

"...ach, no, never!"

"Fantastic! So, Destination Earth!"

The End

