VSA - Very Small Array teleskop

Po trenutno aktualni teoriji fizikalne kozmologije se vesolje približno 300.000 let po velikem poku dovolj ohladi, da se fotoni razklopijo od barionične mase, saj nimajo več dovolj energije, da bi ionizirali vodikove atome v plazmi. Tedaj se srednja prosta pot fotonov v relativno kratkem času poveča iz mikroskopskih dolžinskih skal na kozmološke skale. Ti fotoni tvorijo izredno izotropično prasevanje, ki ga danes zaradi širjenja vesolja opazujemo ohlajenega na približno 2.7 K. Majhne razlike v fizikalnem stanju snovi na tako imenovani površini poslednjega sipanja, v manjši meri pa tudi razmere na poti proti nam, imajo za posledico majhne razlike v temperaturi teh fotonov (približno en del na 100.000). Z meritvijo korelacijskih lastnosti teh fluktuacij na nebesni krogli je mogoče sklepati o vrednostih parametrov kozmološkega modela, kot so sestava, starost, hitrost širjenja in podobno.
Tehnika radijske interferometrije je še posebej primerna za merjenje fluktuacij v prasevanju, saj ponuja izredno močno kontrolo sistematične napake, ki pa pride za ceno naključne napake. Teleskop VSA je sestavljen iz štirinajstih sprejemnikov. Signal iz vsakega para je koreliran z (sin kanal) in brez (cos kanal) faznega zamika četrtine valovne dolžine opazovanega sevanja, kar nam da vrednost kompleksne korelacije med sprejemnikoma. Par sprejemnikov tako deluje kot časovno obrnjen Youngov eksperiment, kjer je posamezen par anten občutljiv na fluktuacije v prasevanju na kotnih skalah reda velikosti, ki so inverzno enake projecirani razdalji med dvema sprejemnikoma merjeni v valovnih dolžinah. Na zaslonu vidimo vrednosti teh korelacij za vse možne pare sprejemnikov, ki pa so povsem preplavljene s šumom sprejemnikov. Velikost signala je namreč reda velikosti zgolj približno tisočinke enote korelacije, ki jih vidimo na zaslonu in ga je zato mogoče na posameznem opazovanem območju zaznati šele po nekaj tedenski integraciji.

dr. Anže Slosar

Kar umetnika zanima v zvezi z možnostmi, ki jih ponujata teleskop Very Small Array (razporeditev anten z zelo majhnimi medsebojnimi razdaljami) in Cambriška univerza (ki upravlja s teleskopom na Tenerifih), se dogaja na področju tehno manipuliranega pogleda. Radijski teleskop VSA nam omogoča videti - tako ali drugače - privilegirano točko v prostoru in času materialnega sveta, in sicer horizont obeh v sliki velikega poka. Teleskop je posebej načrtovan stroj, ki omogoča materialno povezavo s kozmičnim sevanjem. Vendar pa morajo biti podatki meritev teleskopa interpretirani, če hočemo dobiti dvodimenzionalno sliko, kar vnaša drugotne (družbene) diskurze v materialni kontinuum med kozmičnim sevanjem in informacijo, pridobljeno s teleskopom.
1. V galeriji je računalnik s podatki kozmičnega sevanja, ki jih prejemamo s Cambriške univerze prek interneta, s tem pa odpiramo ekskluzivni pogled na začetno točko časa in najoddaljenejše robove vesolja. Meritve naj bi vsebovale materijo, kolikor mogoče čisto, na točki njenega rojstva.
2. Drugi poudarek projekta je medinstitucionalna izmenjava, natančneje menjava med znanstvenim diskurzom in umetniškim kodiranjem, po drugi strani pa tudi med institucijami kot so univerze, galerije in posamezni umetniki. Npr. v zameno za tok podatkov sva oblikovala znak in logotip za teleskop.

Narvika Bovcon, Aleš Vaupotič

VSA - Very Small Array Telescope Art Project (2003)

According to the present theory of physical cosmology the universe reaches the stage when photons do not have enough energy to ionize hydrogen atoms in the primordial plasma roughly 300.000 years after the big bang. This results in light decoupling from the baryonic matter. Consequently the mean free path of photons increases from microscopic to cosmological distances in a relatively short period of time. These photons form an extremely isotropic background, which is further cooled down by the expansion of the universe to the present 2.7K. Small differences in the physical state of matter at the so called surface of last scattering and, to a lesser degree, also conditions on the way to us result in small temperature differences in the temperature of the observed microwave background (about one part in 100.000). By measuring the correlation properties of these fluctuations on the celestial sphere it is possible to constrain values of the cosmological model, such as composition, age, expansion rate and similar.
Radio interferometry is a particularly suitable technique for measuring fluctuations in the cosmic microwave background as it offers superior control of systematic uncertainty. Unfortunately, this comes at the price of a larger random error. The VSA telescope is composed of 14 receivers. Signal from each pair of receivers is correlated with (sin channel) and without (cos channel) a phase difference corresponding to quarter wavelength of the incoming radiation. This gives a measurement of a complex correlation between a pair of receivers. Each pair thus functions as a time-reversed Young's experiment and is thus sensitive to fluctuations in the microwave background at angular scales that are inversely equal to the projected separation between aerials measured in wavelengths. The screen shows these correlation values for all possible pairs of receivers. These are, however, flooded with receiver noise. The cosmological signal is at the level of around one thousandth of the correlation unit shown on the screen. Thus the real signal can be detected only after several weeks of integration.

Anže Slosar, PhD

The artistic interest in the possibilities that are made available to us by the Very Small Array telescope and the University of Cambridge concerns the problem of the techno-manipulated gaze. The radio telescope VSA enables us to see - in one way or another - a privileged point in space and time of material world, the horizon of them both in the image of the big bang. The telescope is a custom made machine that enables the material connection with the cosmic radiation. But in order to obtain a two-dimensional image, the data has to be interpreted whereby other discourses not necessarily linked to the material continuum spreading from cosmic radiation to the information are introduced.
1. In the gallery there is a computer with data of the cosmic radiation measurements, and thus, through internet, an exclusive view is opened into the starting point of time and the far end point of space. The measurements should contain the matter as pure as possible at the point of its birth.
2. The second emphasis of the project is the interinstitutional exchange, particularly the exchange between the scientific discourse and the artistic codification, but also between institutions such as universities, galleries, academies and individual artists. E.g. in exchange for the data-stream we designed the sign and the logo for the telescope.

Narvika Bovcon, Aleš Vaupotič