

# INDEED SMALL, BUT SMART.... SMALL TELESCOPES IN THE AI ERA

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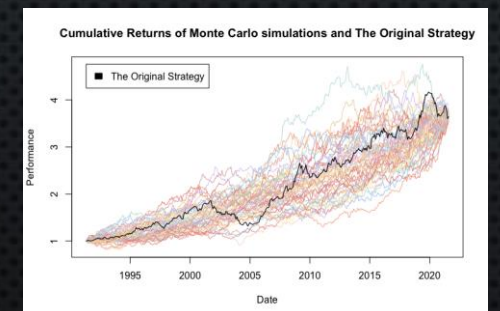
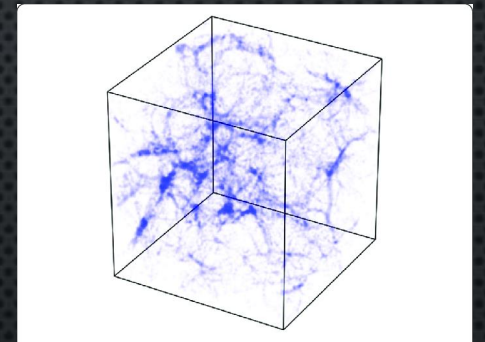
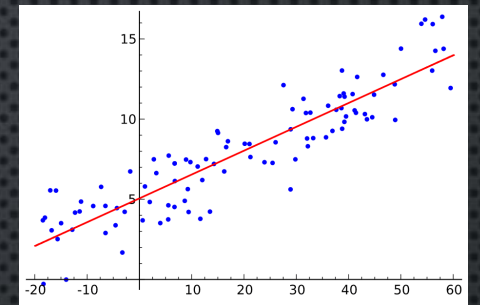


- WHETHER WE LIKE OR NOT WE ENTERED THE “AI ERA”
  - IN THE PAST WE DID THINGS
  - THEN WE MADE THINGS TO HELP US DOING THINGS
  - THEN WE MADE THINGS TO HELP US DOING THINGS BETTER
  - THEN WE MADE THINGS DOING THINGS WE WERE NOT ABLE TO DO AT ALL
  - THEN WE MADE THINGS TELLING US WHAT WE SHOULD OR SHOULD NOT DO
  - ..... WORK IN PROGRESS.....
- **AI IS A THING INVENTED, MADE AND OPERATED BY US....**
- **WE ARE THE *NATURAL STUPIDS* TO BLAME WHATEVER HAPPENS DUE TO OR THROUGH AI.**





- AI IN ASTROPHYSICS IS MAINLY **MACHINE LEARNING**
  - ML MAKES PREDICTIONS (AND DECISIONS IF ASKED TO DO SO...) BASED ON A LARGE DATA BASE OF HISTORICAL DATA.
  - ML CREATES MODELS WHICH DOES NOT FOLLOW PRE-PROGRAMMED BEHAVIOURS BUT LEARNS FROM THE DATA OFFERED TO TRAIN THEM.
- ASTROPHYSICS IS USED TO **"LEAST SQUARES"** AND DERIVED METHODOLOGY
  - FITTING A MODEL TO LARGE DATA BASES
- ASTROPHYSICS IS USED TO **"N-BODY SIMULATIONS"**
  - PREDICT THE EVOLUTION OF A DYNAMICAL SYSETEM BASED ON "ASSUMPTIONS"
- ASTROPHYSICS IS USED TO **"MONTECARLO SIMULATIONS"**
  - PREDICTIONS BASED ON COMBINED PROBABILITY, DEVELOPED DURING WORLD WAR II
  - SIMULATING DATA WHEN DATA ARE NOT AVAILABLE
- **ASTROPHYSICS SHOULD NOT BE SURPRISED BY AI (ML) AND CONSIDER IT AN INCREMENTAL EVOLUTION OF TRADITIONAL METHODOLOGY**





# SMALL TELESCOPES IN ASTROPHYSICS

- THIS WEEK WE HAVE BEEN EXPLORING THE PROS OF SMALL TELESCOPES
  - LONG OBSERVING BASELINES
  - EASY ACCESS
  - FAST POINTING
  - LATITUDE-LONGITUDE DISTRIBUTION
  - ROBOTIZATION
- AND ALSO THE CONS
  - SOMEWHAT LIMITED INSTRUMENTATION
  - SOMETIMES LOWER RELIABILITY
  - STANDARDS AND INTEROPERABILITY
- **SMALL TELESCOPES INJECT THEIR DROP OF LIQUID IN THE WATER TANK.....**
  - IF THE LIQUID IS CLEAR WATER NO ONE WILL NOTICE....
  - IF IT IS BLACK INK ANBODY WILL NOTICE IT....





# WHAT IS BLACK INK ?

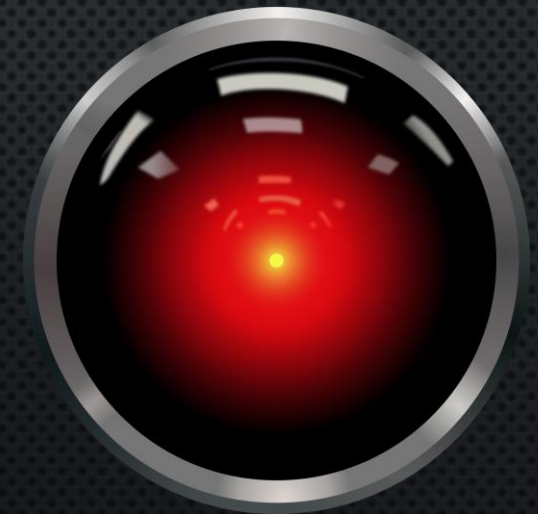
- BLACK INK IS WHAT MAKES THE DIFFERENCE...
  - AN EARLIER OBSERVATION
    - BEING FIRST ON A TRANSIENT AND DISTRIBUTING THE COORDINATES.....
  - AN UNIQUE OBSERVATION
    - ONLY IR PHOTOMETRIC (OR POLARIMETRIC, OR WHATEVER) OBSERVATION.....
  - A DEEPER OBSERVATION
    - NOBODY ELSE GOT THAT FAR.....
  - A SERENDIPITY DISCOVER
    - A TRANSIENT, A SUPERNOVA, A COMET.....
- YOU WILL NORMALLY KNOW "A POSTERIORI" IF IT WAS BLACK INK OR NOT... WE ARE MANY TIMES SHOOTING IN THE DARK...
- FISHING MORE THAN FARMING FISH





# PRE-DETERMINING THE BLACK INK

- WOULD BE GREAT TO KNOW IN ADVANCE **IF WE ARE POURING WATER OR BLACK INK** AT LEAST WITH SOME LEVEL OF PROBABILITY.....
- HOW COULD WE POSSIBLY DO THIS ? ASK THE ML **"BIG BROTHER"** (OR **"GREAT MOTHER"**)
  - SHE/HE KNOWS, BY CHEWING LARGE DATA-BASES, **WHAT IS RELEVANT** BUT ALSO **WHAT IS NOT RELEVANT** FOR A CERTAIN SCIENTIFIC TARGET
- OUR PERSONAL **HAL 9000** COULD POLITELY TELL US:
- *INSTEAD OF STUBBORNLY INSISTING ON THAT IRRELEVANT PLANETARY TRANSIENT THAT WILL BE ANYWAY OBSERVED TONIGHT FROM 20 OTHER SMALL TELESCOPES WITH SIMILAR INSTRUMENTATION TO YOURS, WHY DON'T YOU OBSERVE THAT FLARING BLAZAR FOR WHICH "THE SYSTEM" HAS ONLY 2 CHECKED-IN SITES ?*





# LET ME DO IT..... (FOR YOU)

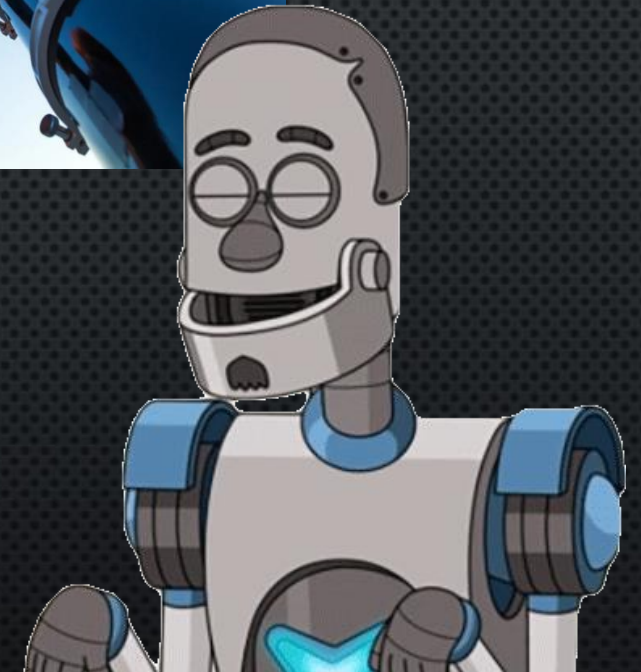
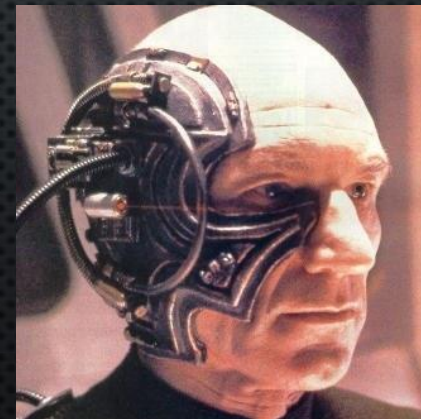
- *I APPRECIATE YOU CLEVERLY DECIDED NOT TO DO WHAT YOU WANTED BUT WHAT I SUGGESTED YOU TO DO. HOWEVER DUE TO YOUR NATURAL STUPIDITY YOU WILL LIKELY MAKE MISTAKES DURING THE OBSERVATIONS TONIGHT.*
- SO WHY YOU DON'T JUST CONNECT YOUR TELESCOPE WITH MY COLLECTIVE (ARTIFICIAL) BRAIN AND LET ME DO THE REST ? (INTERNET OF THINGS)
- I CAN EVEN SUGGEST YOU A FEW SERIES ON NETEFLEX TO PASS THE NIGHT AWAY WHILE I WORK FOR YOU (.... WELL... NOT FOR YOU INDIVIDUALLY... FOR THE COLLECTIVITY
- ARE WE READY TO HAND OVER ?





# SERVICE MODE VERSUS VISITOR MODE....

- MY GENERATION USED TO WRITE DOWN PROPOSALS TO LARGE FACILITIES REQUESTING VISITOR MODE "BECAUSE I DO THE OBSERVATIONS BETTER".
- THE COMPARISON WAS BETWEEN OURSELVES AND ANOTHER HUMAN BEING.... WITH PROBABLY AN ORDER OF MAGNITUDE LARGER EXPERIENCE IN USING THE TELESCOPE..... BUT A HUMAN BEING...
- IF WE NOW TRY THE SAME COMPARISON WITH AN AI-BASED BOT THE BOT WON'T LOUGH.... ONLY BECAUSE IT DOESN'T KNOW HOW TO LOUGH...FOR THE TIME BEING.....
- WE HANDED OVER TO NIGHT ASTRONOMERS IN THE PAST AND WE WILL HAND OVER TO BOTs NOW...
- ..... "RESISTENCE IS FUTILE" ....





# ARE WE HAMSTERS OR RULERS ?

- WE MAY THINK WE ARE TURNING OURSELVES AND OUR SMALL TELESCOPES INTO **HAMSTERS** HAPPILY RUNNING IN THE WHEEL...



- WE COULD ALSO DEPICT US AS NAV'I FOLLOWING OUR **EYWA** ON OUR PERSONAL PANDORA....

- BUT IN FACT WE REMAIN **"THE CREATOR"** OF **V'GER**....NO AI SYSTEM CAN "LIVE OR GROW" WITHOUT THE HUMANS....





- CREATIVE AI (CHATGPT.... BUT MORE IN GENERAL AI) WORKS ON THE **PROMPT-BOT PAIR**.
  - THE PROMPT IS THE QUERY YOU SUBMIT TO THE BOT TO OBTAIN SOMETHING.
  - THE PROMPT IS WHERE THE **HUMAN CONTROL RESIDES**
- **IN OUR CASE THE PROMPT IS THE SCIENCE CASE AND ITS INTERPRETATION.**
- A BOT IS A MEGA-CORRELATOR AND CAN ONLY PROPOSE SOLUTIONS **ALREADY FOUND** AT LEAST PARTIALLY.
- A BOT-RULED WORLD WOULD LEAD TO SATURATION IN A ZERO-DIVERGENCE KNOWLEDGE ENVIRONMENT WHEN **"ALL IS SAID AND DONE"** (THE V'GER PARADIGM).....
- **...BUT WE ARE FAR AWAY FROM THERE....**



- **ASTROPHYSICS IN GENERAL, AND SMALL TELESCOPES COMMUNITY IN PARTICULAR, HAVE PARTIAL PROMPTS AND LIMITED BOTs.**
- **ONE EXAMPLE: THE TRIGGER**
  - WE ARE USED TO SEE A TRIGGER AS A POSITION WITH AN ERROR-BOX.
  - POINT THERE AS FAST AS YOU CAN WITH ALL INSTRUMENTS YOU HAVE AT HAND.
  - **LARGE TRANSIENT DISCOVERY MACHINES (E.G. VERA RUBIN) OR EXOPLANET SEARCH FACILITIES (E.G. PLATO) WILL SEND "SELECTIVE TRIGGERS" FOR SPECIFIC TYPES OF OBSERVATIONS AND OBSERVATORIES. BETTER BOT**
- **ANOTHER EXAMPLE: THE CATALOGUES**
  - "MENUS" ARE AVAILABLE ON THE WEB OF POTENTIAL TARGETS. IN SOME CASES WITH SPECIFIED "INGREDIENTS" SO THAT WE CAN **SELECT OUR FAVOURITE DISH AND AVOID DANGEROUS ALLERGIES.**
  - **HOWEVER WE PICK UP THE TARGET WITH LIMITED FORESIGHT OF THE IMPACT ON THE GENERAL SCENARIO OF OUR SELECTION**



- ASK NOT WHAT YOUR TELESCOPE **CAN** OBSERVE TONIGHT —  
ASK WHAT YOUR TELESCOPE **SHOULD** OBSERVE TONIGHT ....



- HAVE A SINGLE PROMPT:
  - *I HAVE A 60 CM TELESCOPE WITH AN UBV CCD CAMERA, THE NIGHT IS GREAT THE SEEING IS GOOD AND THERE IS NO MOON... WHAT IS WORTH DOING TONIGHT ?*
- HAVE A GOOD BOT:
  - *HERE COMES YOUR OBSERVING SCHEDULE FOR TONIGHT DARLING....*





..... to seek out new life and new civilizations; to boldly go where no man has gone before!