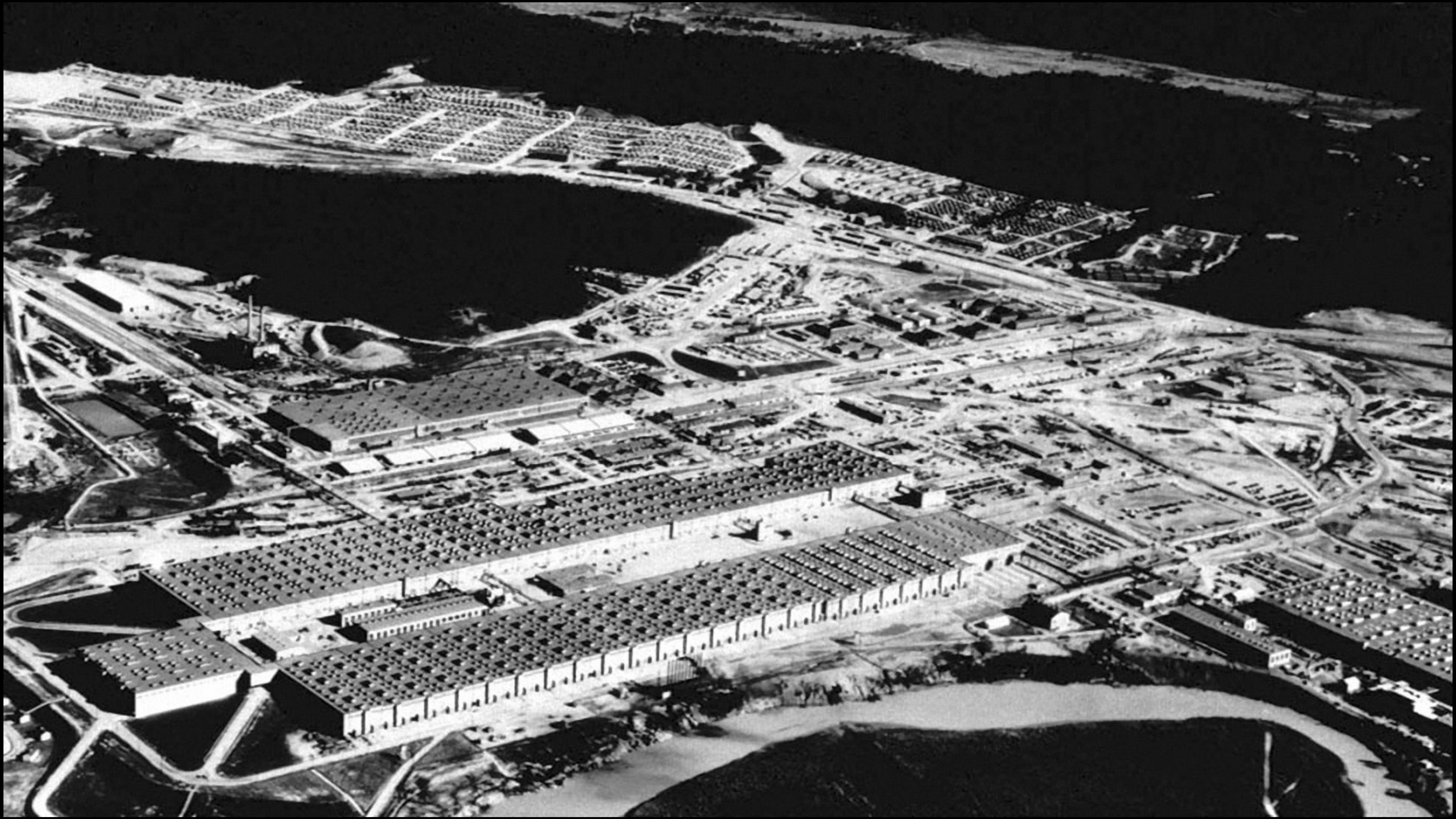
K-25 uranium enrichment plant. Oak Ridge, Tennessee



LA - 602

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August 14, 1946 This document contains 20 pages.

IGNITION OF THE ATMOSPHERE WITH NUCLEAR BOMBS

WORK DONE BY:

REPORT WRITTEN BY:

E. J. Konopinski
C. Marvin
E. Teller

[redacted]

APPROVED FOR PUBLIC RELEASE

ABSTRACT

It is shown that, whatever the temperature to which a section of the atmosphere may be heated, no self-propagating chain of nuclear reactions is likely to be started. The energy losses to radiation always overcompensate the gains due to the reactions. This is true even with rather extravagant assumptions concerning the reactivity of the nitrogen nuclei of the air. The only disquieting feature is that the "safety factor", i.e. the ratio of losses to gains of energy, decreases rapidly with initial temperature, and descends to a value of only about 1.6 just beyond a 10-Mev temperature. It is impossible to reach such temperatures unless fission bombs or thermonuclear bombs are used which greatly exceed the bombs now under consideration. But even if bombs of the required volume (i.e., greater than 1000 cubic meters) are employed, energy transfer from electrons to light quanta by Compton scattering will provide a further safety factor and will make a chain reaction in air impossible.

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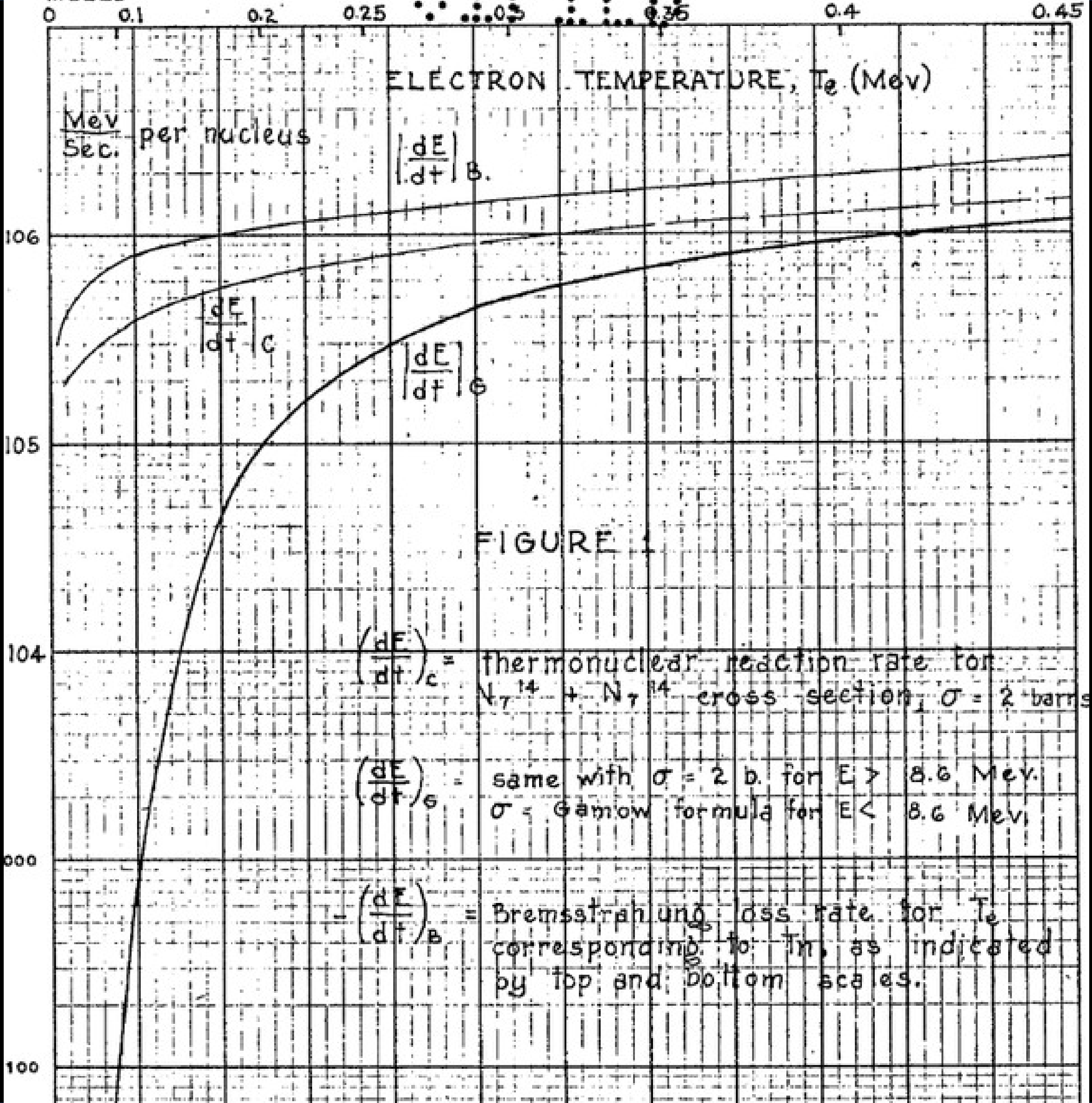
Calculations used to justify continuing with the atomic test. 1944



123783

12 April 1945

R

230.61 T-Hazards
MED TRI Bx 27

HAZARDS OF TRINITY EXPERIMENT

Section I - Hempelmann

A self appointed committee consisting of R.R. Wilson, E. Segre, J. Hirschfelder, R. Watts and L.H. Hempelmann met on two occasions to consider the hazards related to the tests at Trinity. At the second meeting, Mr. Bainbridge, Mr. Williams and Mr. Moon were also present. Thus far, the hazards which have been considered are limited to the immediate dangers to personnel on the site and in surrounding areas from blast, fragments, radiation, radioactive ~~poison~~ materials, heat and visible light. The dangers to individuals entering contaminated areas after the shot and the medical legal complications of the shot have not been considered thoroughly as yet. Neither has the case been considered where the energy of the explosion exceeds all expectations and results in an activation of the nuclei of the tamper material. The dangers from ozone and No have not been calculated. All calculations have been made in such a way as to determine the worst possible conditions.

The immediate purpose of considering hazards at this time is to enable us to draw up a plan of monitoring the experiment so that construction of health monitoring instruments can begin. This plan is presented in Section II by R. Watts. Although this organization will undoubtedly be changed considerably, the type of monitoring instruments is probably not subject to change.

The calculations for the immediate hazards follow:

(1) Blast: It has been calculated by Hirschfelder that for a 10,000 ton explosion the blast wave at the shelters (10,000 m) will be 0.2 p.s.i. Even in the case of a 100,000 ton explosion the pressure at the shelters will not exceed 1.5 p.s.i. According to Penny and Marley the personnel in the shelters will not be endangered even by the latter blast wave.

(2) Fragments: It has been calculated by Zimmerman, (reference memorandum to Bainbridge, 2 October 1944) that the danger from fragments would be maximum in the case of a relatively small explosion of 50 to 500 tons. In this case, a fragment with a range of 10,000 yards would have to have an initial weight of from 230 to 500 lbs. A fragment of such size would only result in the case of a non-symmetrical explosion using Jumbo. Even here the maximum would probably be less than 10,000 yards.

(3) Heat accompanying blast wave: According to Hirschfelder, the rise in temperature produced by the blast wave will probably not exceed 10 degrees at 10,000 yards.

(4) Light: At 10,000 yards the ball of fire from a 10,000 ton explosion will have the luminosity of about 30 suns for less than 1 millisec; the average luminosity for 1 second will be one sun. At a distance of the nearest town (approximately 20 miles) the luminosity will be completely without danger to people who may be looking in the direction of the ball of fire.

SECRET

(5) Radiation Hazards: Weisskopf's maximum estimate of gamma radiation is 2000 R at 600 meters and 10^{-26} R at 10,000 meters. At the latter distance the neutron flux would be less than one neutron per square cm.

(6) Radioactive Materials: The worst possible hazard from radioactive dusts would seem to be one in which the explosion is of sufficient energy to only get the material in the form of a cloud of fine dust. In this case, assuming that there would be a 5 degree angle of spread of the cloud, the initial 5 kg. of 49 would be contained in 3000 ft (cubic) six miles from the zero point. Assuming that the dust is uniformly distributed throughout this volume, each litre will contain .006 micrograms of active material. Assuming that one microgram is a dnagerous amount of 49 and that the respiratory rate is 20 litres/minute, the cloud of dust would be dangerous at the shelter to breathe for more than 8 minutes. This hypothetical case would necessarily mean that the danger would be temporary since the dust cloud would drift by the shelters. If the dust cloud should drift to the nearest town (20 miles away) its volume would be 3×10^{13} litres which would mean about 10^{-4} micrograms of active material per litre; the cloud would then be dangerous to breathe for more than 500 minutes. This too, would represent only a temporary condition unless some form of precipitation might result in the deposition of the entire cloud on the town.

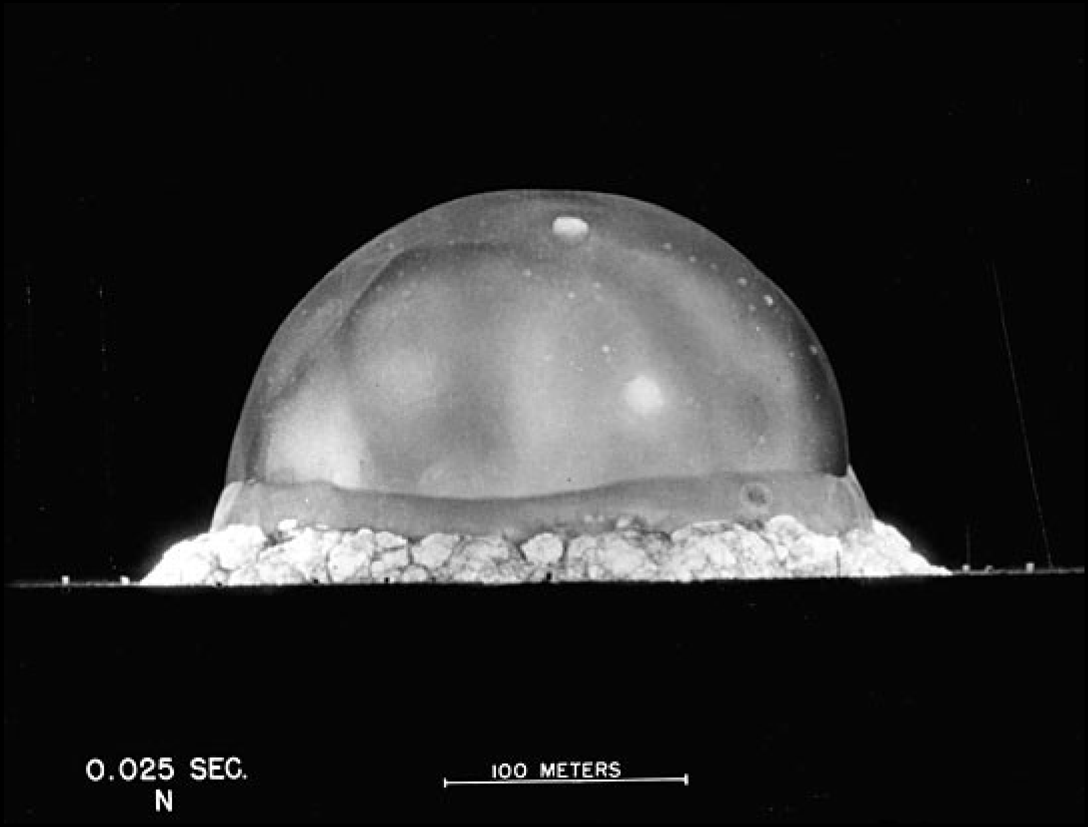
The dangers from fission products would probably be considerably less than from alpha particles since they would be formed only by a more efficient explosion, which would result in the cloud of dust being carried higher into the air by a ball of fire and better dilution in air. Assuming that the beta and gamma fission fragments were formed in a cloud similar to that described above the maximum radiation intensity in the cloud at 10,000 meters would be approximately 2×10^{8} R/min.

Plan for monitoring the experiment for the hazards described follows in Section II. Although the medical legal aspects of the problem have not been considered, it is planned to get permanent records of the measurements in the shelters as well as in the town for future reference.

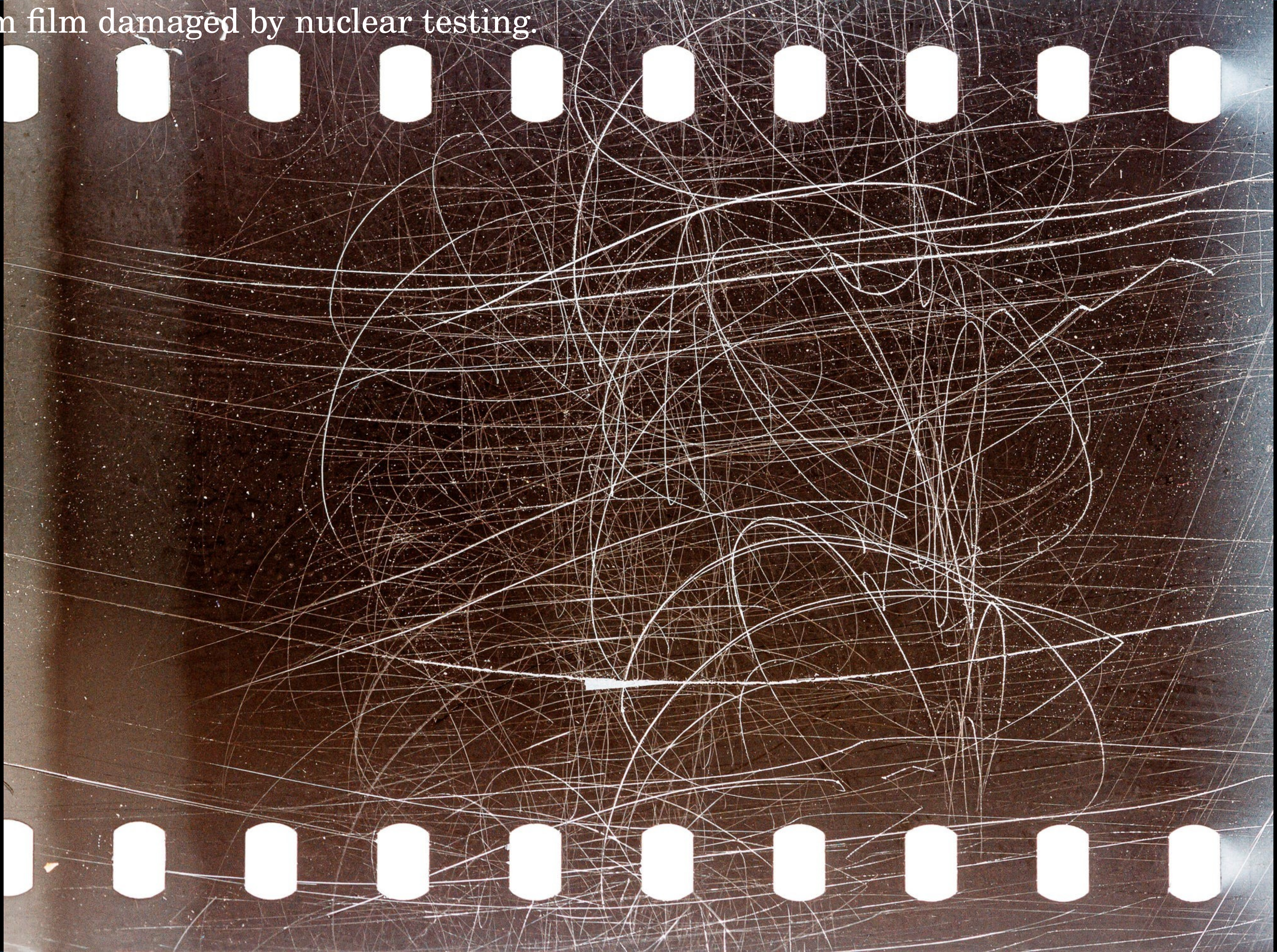
Kenneth Hickman — Chem of Commerce U of Rochester
Heat
Notify Mitchell
Schaffers. Tanks, Where are they, How many

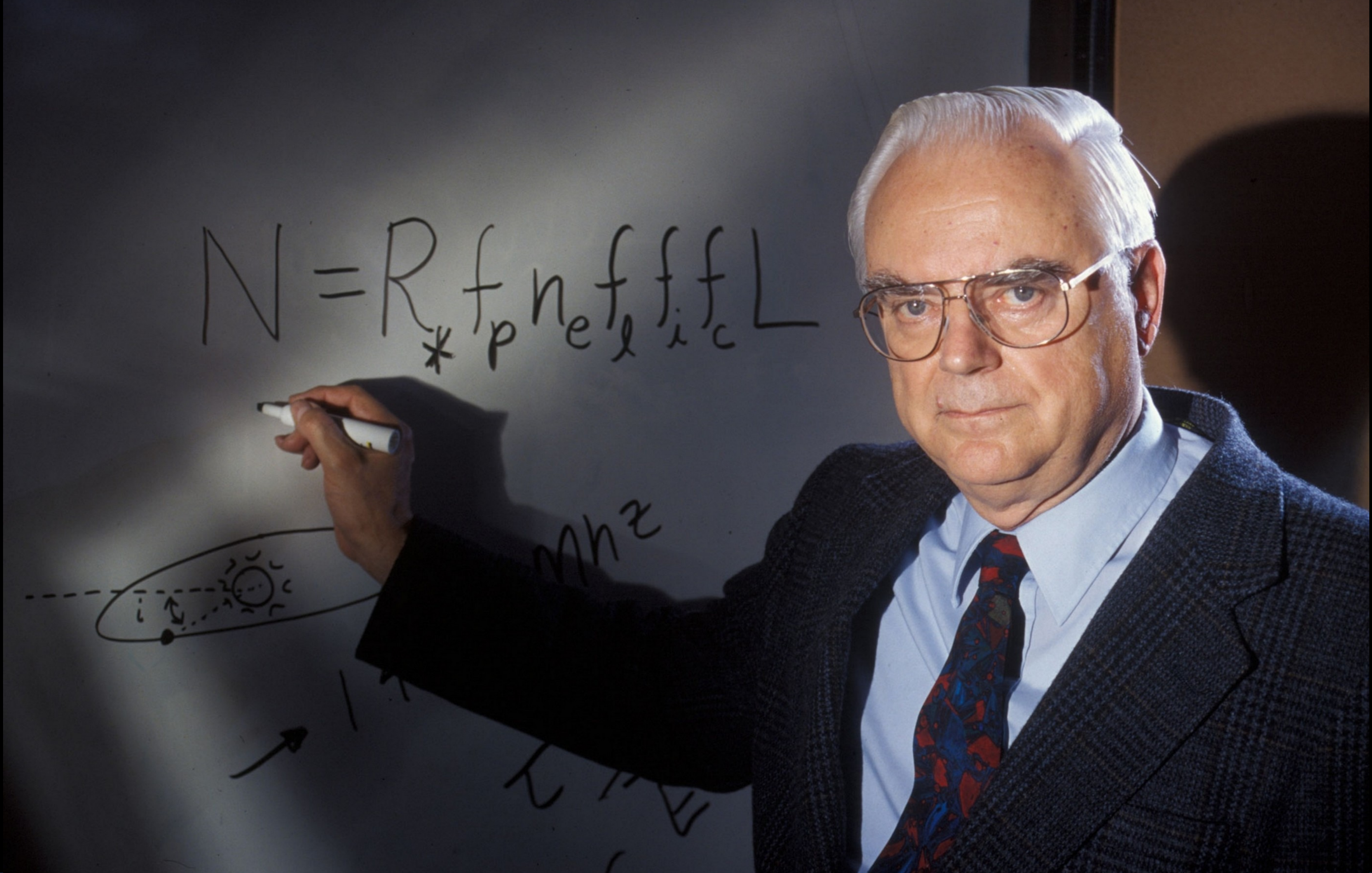
Pre test Trinity “gadget”. New Mexico

Trinity test fireball taken, on a rapatronic camera. New Mexico



Kodak 35mm film damaged by nuclear testing.

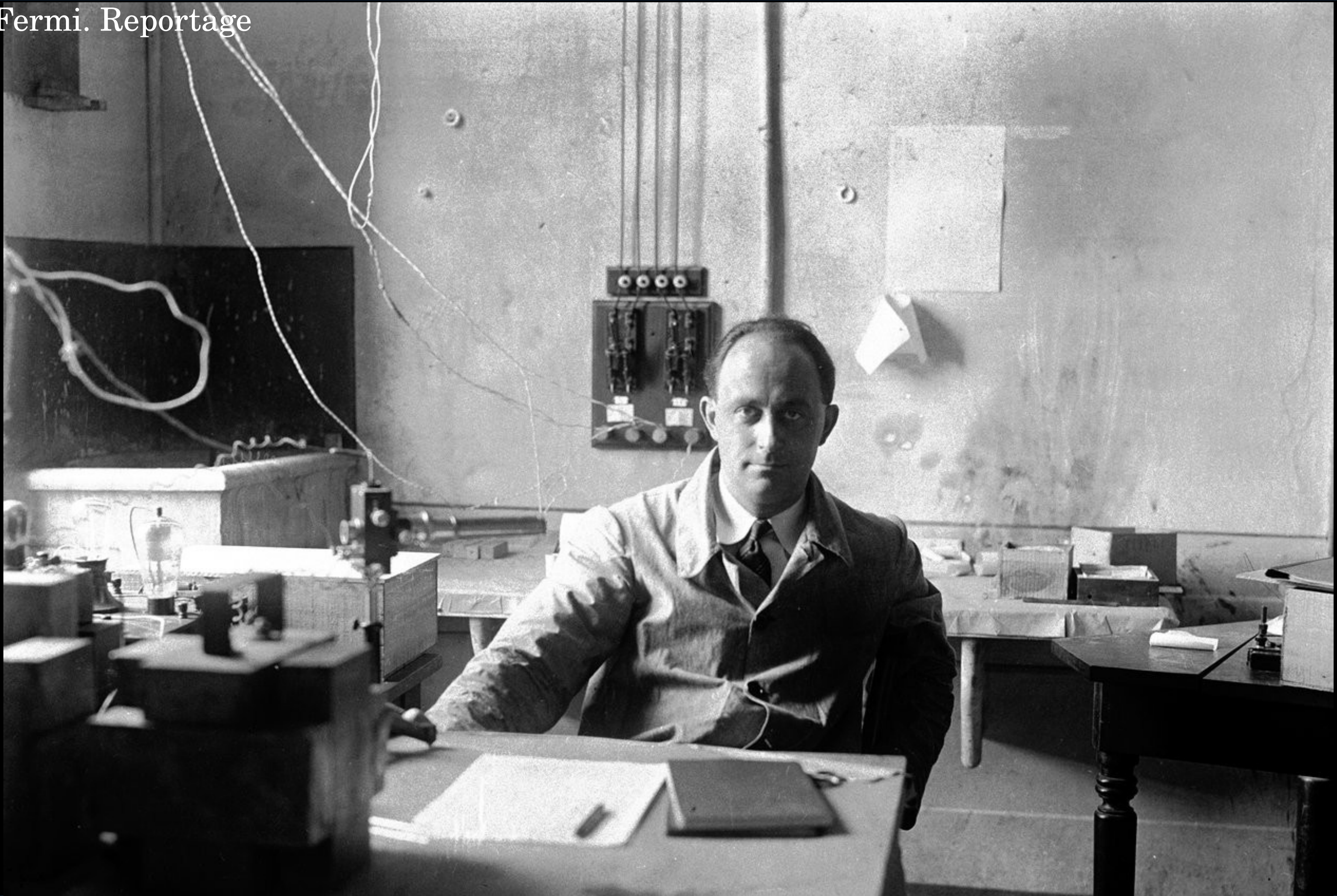




Frank Drake with his eponymous equation. Cornell University

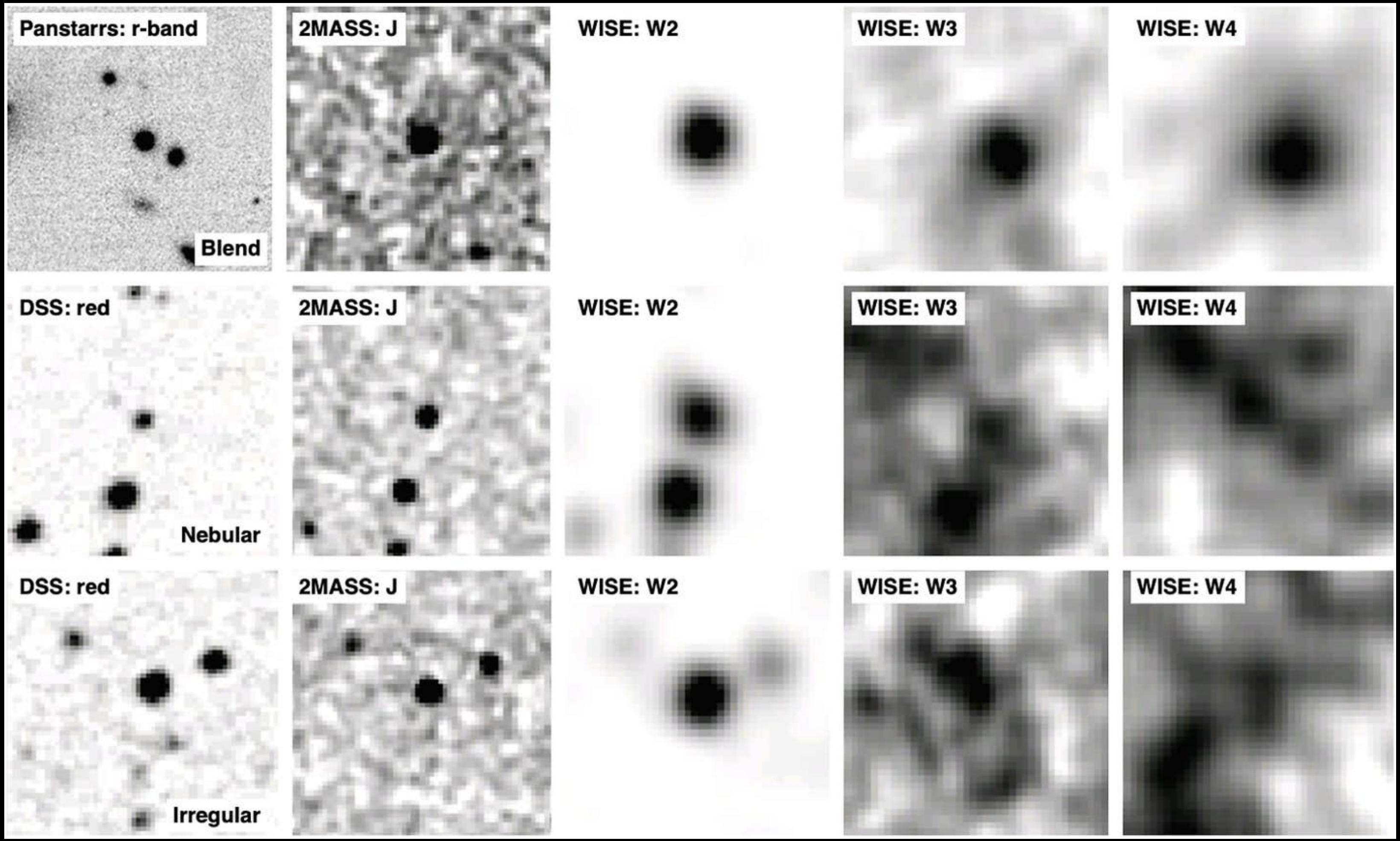
Fuller Lodge lunch hall. Los Alamos Laboratories

Enrico Fermi. Reportage



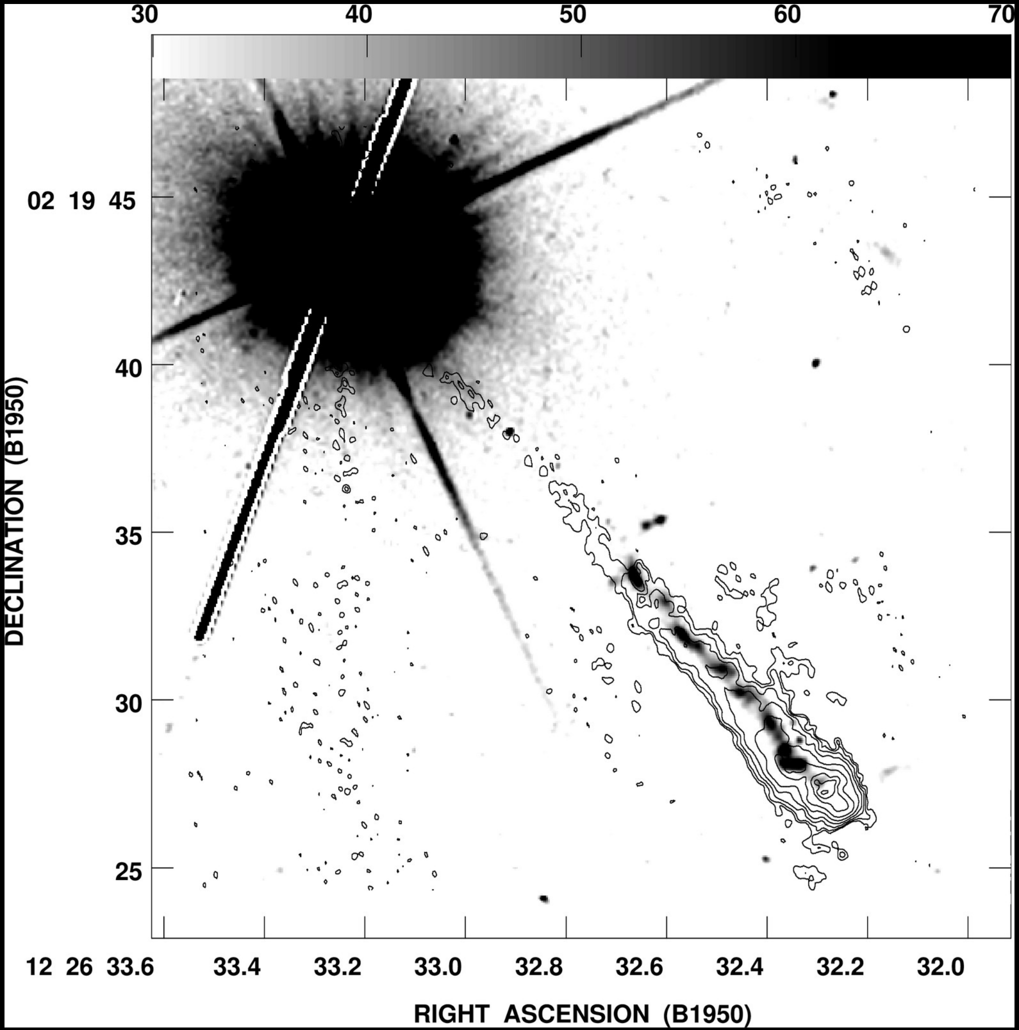
National radio astronomy observation VLA (very large array), used for SETI research. New Mexico

Dyson sphere candidate stars from DR3, 2MASS and WISE

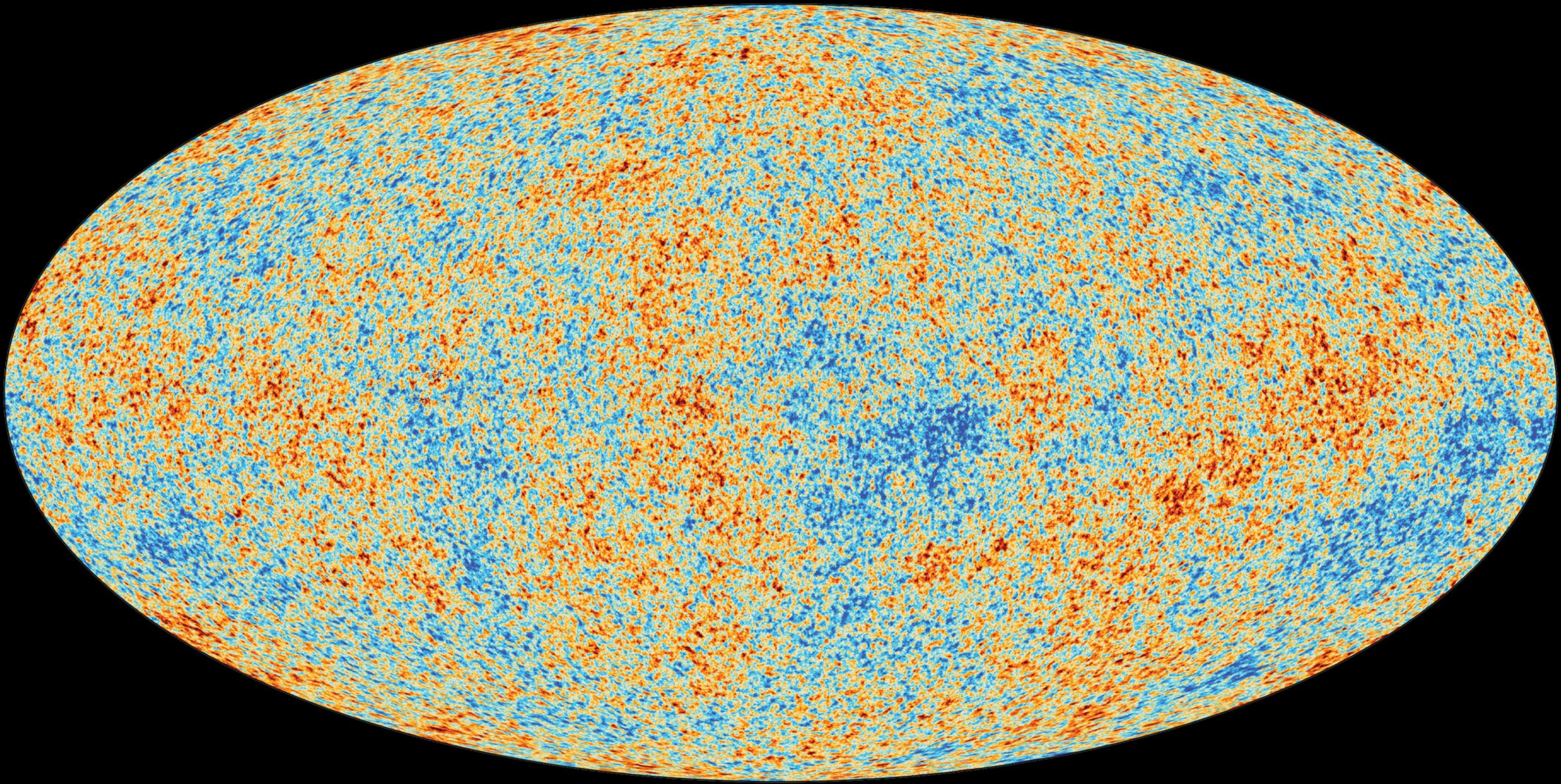


Radio imagery of the night sky. NRAO

Radio imagery of the first quasar recorded – Q 3C 273.



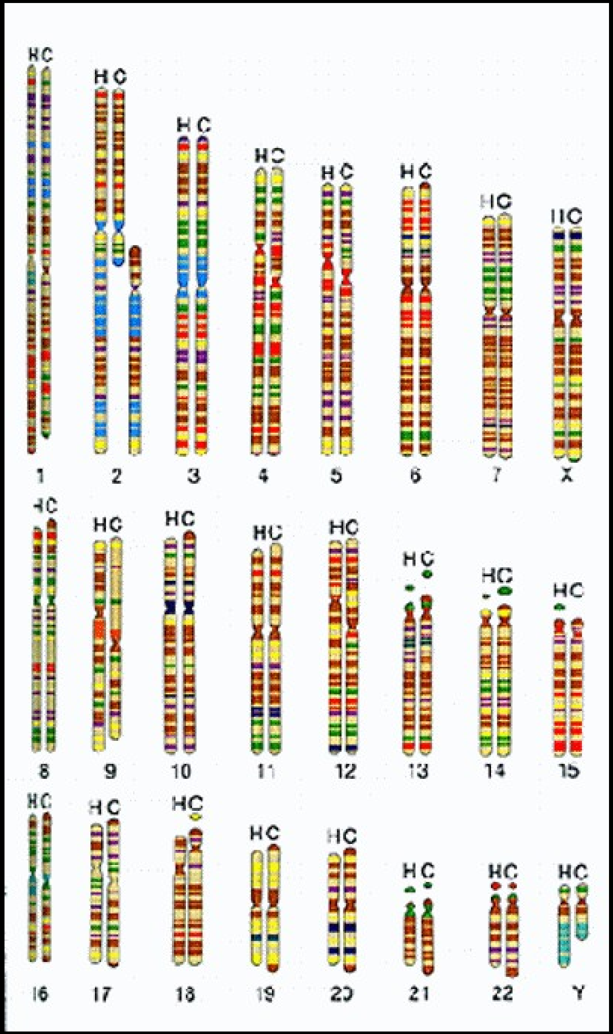
Plank telescope image of CBR.



Lian Bua cave. Site of first Floresiensis remains. Flores, Indonesia

Volcanic caldera on Flores. Indonesia.

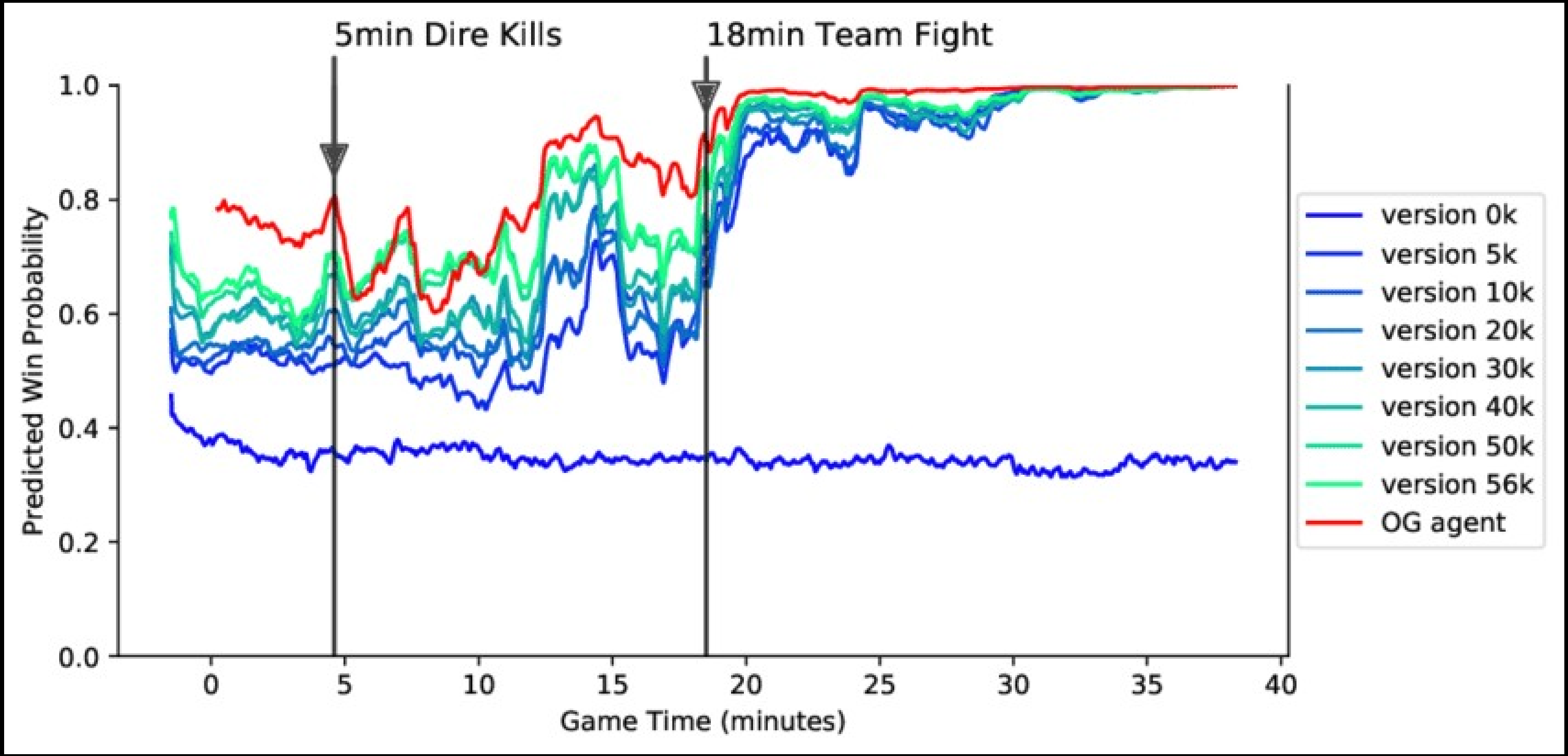
H – human, and C – chimp chromosome comparison. #2 is the one that fused.



Ford motor company casting plant. Flat Rock, Michigan

David Chalmers. De La Salle University, Manilla

OpenAI win probability graph in BO5 vs team OG.



James Lovelock. 1962

Press release paper regarding the safety of the LHC.

Black hole production at the LHC

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Abstract

In the TeV gravity scenarios, black holes are expected to be produced at the Large Hadron Collider (LHC) in CERN. In this article, we review the current status of the theoretical studies on this issue. After a brief overview, we explain our studies on the apparent horizon (AH) formation in high-energy particle collisions.

1 Introduction

Almost a decade ago, scenarios in which the Planck energy M_p could be $O(\text{TeV})$ were proposed [1]. In these scenarios, our 3-dimensional space is a brane floating in large extra dimensions, and gauge particles and interactions are confined on the brane. Since the TeV scale energy will be reached by the Large Hadron Collider (LHC) in CERN, we have a possibility to observe quantum gravity phenomena by experiments. Specifically, in the collision with the energy much higher than the Planck scale, the black hole production is expected [2]. Since the LHC is planned to begin operation in 2008, the black hole production at the LHC is a very timely topic. In this article, we review the theoretical studies on this issue. We give a brief overview in the next section. In Sec. 3, we focus attention to our studies on the apparent horizon (AH) formation in high-energy particle collisions.

2 Brief overview

The LHC is designed so that protons collide with the center-of-mass energy 14 TeV. In the collisions, the partons interact with each other and black holes could be produced in these processes. If a black hole is produced, it emits mainly the gravitational wave and become a stationary higher-dimensional Kerr black hole (the balding phase). Then, the black hole will evaporate by the Hawking radiation (evaporation). The particles emitted in this process can be observed by the detectors such as the ATLAS. In the final phase of evaporation, the quantum gravity effects may become important (the Planck phase). Let us look at these issues one by one.

2.1 Production rate

The black holes with mass (few)M_p are expected to exist, since its gravitational radius is larger than the Planck length. Then the trans-Planckian collision is expected to cause the gravitational collapse if the impact parameter is smaller than the gravitational radius $r_h(\sqrt{\tau s})$ of the parton-pair system. Thus the parton-parton cross section for the black hole production is estimated as $\sigma_{ij\to bh}(\tau s) \sim \pi[r_h(\sqrt{\tau s})]^2$. In order to obtain the proton-proton cross section for the black hole production, one should multiply the parton distribution functions and take the sum over all possible parton pairs:

$$\sigma_{pp\to bh}(\tau_m, s) = \sum_{ij}\int_{\tau_m}^1 d\tau \int_\tau^1 \frac{dx}{x} f_i(x) f_j(\tau/x)\sigma_{ij\to bh}(\tau s). \qquad (1)$$

Based on this calculation, the black hole production rate is expected to be 1Hz in the most optimistic estimate [2]. We remark that the production rate depends on the effect of balding and the black hole threshold mass. Also, the value of $\sigma_{ij\to bh}$ should be estimated by a direct calculation. The topics in Sec. 3 are related to these issues.

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GoF pathogen leak paper.

frontiers in PUBLIC HEALTH

OPINION ARTICLE
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The consequences of a lab escape of a potential pandemic pathogen

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Keywords: potential pandemic pathogen, lab-acquired infection, H5N1, H7N9, gain of function

In letters to the journals Science and Nature (1, 2), 22 virologists notified the research community of their interest in expanding research to develop strains of the already deadly H7N9 Asian influenza virus that would be transmissible via aerosols among mammals, thus creating potential pandemic pathogens. PPPs are defined as pathogens that are potentially highly contagious, potentially highly deadly, and not currently present in the human population. Mammalian contagious avian flu, the 1918 pandemic flu, and SARS are examples. The letter writers cite their scientific reasons for the need for such research, much the same reasons as given by those working on similar projects for the H5N1 avian flu virus (3, 4). This new proposed research signals wider interest in making dangerous influenza viruses (5, 6) contagious in mammals via respiratory aerosols. At present, there are no international regulations or guidelines in place to decide whether such a research project should proceed.

Now is the time to address the next critical question: what is the likelihood that one of these viruses will escape from a lab and seed the very pandemic the researchers claim they are trying to prevent? As we shall estimate, that probability could be as high as 27%, a risk too dangerous to live with.

First, from the calculations in two in-depth pandemic risk analyses (7–9), there is a substantial probability that a pandemic with over a 100-million fatalities could be seeded from an undetected lab-acquired infection (LAI), if a single infected lab worker spreads infection as he moves about in the community. From the Klotz (2014) analysis, there is about a 1–30% probability, depending on assumptions, that, once infected, the lab worker will seed a pandemic. This large probability spread arises from varying the average number of people infected by an infected person between 1.4 and 3.0 (R_0, in standard epidemiology notation), varying the details of commutes to and from work on public transportation, and whether infected acquaintances are quarantined before spreading infection. The Merler (2013) study, based on a computer-generated population grid of size and varying density of the Netherlands, supports our concern over a lab escape not being detected until it is too late: "there is a non-negligible probability (5–15%), strongly dependent on reproduction number and probability of developing clinical symptoms, that the escape event is not detected at all."

Different methodologies were used in the Klotz (2014) and Merler (2013) risk analyses. Additional analyses are needed using other methodologies, such as the mathematical model employed for SARS (10), which hopefully will lead to some consensus on risk. The Klotz and Merler studies, however, are the first to raise these concerns and point to valid issues about the potential risks from a single LAI.

Given such a dire predicted outcome by the existing studies, the critical question is: what is the probability that a worker acquires an undetected infection in the lab in the first place? To answer this question, we reproduce here one part of the Klotz (2014) analysis: the probability of an escape through an LAI from at least one of the many labs expected to be involved in this research enterprise.

A 2013 Centers for Disease Control report is a significant source of recent data on LAIs (11). The report documents four undetected or unreported LAIs in registered US Select Agent, high-containment BSL-3 labs between 2004 and 2010. An undetected or unreported LAI implies an escape when the infected person leaves the lab. The report identifies an average of 292 registered Select Agent BSL-2, BSL-3, and BSL-4 labs operating over those 7 years, for a total of $292 \times 7 = 2{,}044$ lab years. Unfortunately, the study does not break down numbers into BSL-2, BSL-3, and BSL-4 labs or lab years.

Thus, the probability of escape for a single year, p_1, can only be calculated as 4 LAIs/2,044 lab years = 0.002 or 0.2% per lab per year. This is clearly an underestimate since BSL-2 and BSL-4 labs contribute to the denominator. (The denominator used here, 2,004, equals the number of BSL-2 plus number of BSL-3 plus number of BSL-4 labs. But the denominator in our calculation should be just the number of BSL-3 labs, so the denominator is overestimated and the percent escape is then underestimated. Although requested, the CDC has not supplied us with the number of BSL-3 labs for us to do the exact calculation.) This basic probability is consistent with that for SARS escapes in Asia through LAIs (12) and with all known escapes from BSL-4 labs in the Soviet Union from LAIs and Great Britain from a mechanical failure (13).

To illustrate potential risk, the probability of no escape from a single lab in a single year is $(1 - p_1)$, so

$$p_{no} = (1 - p_1)^{N \times Y} \qquad (1)$$

is the probability of no escape from N labs in Y years. And